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**REPORT TO THE JOINT COMMITTEE
ON ATOMIC ENERGY
CONGRESS OF THE UNITED STATES**

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MAY 11 1977

**Management Improvements Needed
In The Review And Evaluation Of
Applications To Construct And
Operate Nuclear Power Plants** B-127945

Atomic Energy Commission

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**BY THE COMPTROLLER GENERAL
OF THE UNITED STATES**

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U. S. General Accounting Office



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MAY 11 1977

Dear Mr. Chairman:

This is our report on management improvements needed in the review and evaluation of applications to construct and operate nuclear power plants. The review was made in accordance with your request dated June 18, 1971.

Copies of this report are being sent to the Vice Chairman of your Committee and to the Atomic Energy Commission.

We believe that the contents of this report will be of interest to other committees and members of Congress. Therefore, as agreed to by the Committee, we are making distribution to such other committees and members of Congress.

Sincerely yours,

Comptroller General
of the United States

The Honorable John O. Pastore, Chairman
Joint Committee on Atomic Energy
Congress of the United States

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C o n t e n t s

		<u>Page</u>
DIGEST		1
CHAPTER		
1	INTRODUCTION	5
	Description of internal application re- view process	7
	Increase in licensing work load	11
2	NEED FOR IMPROVED GUIDANCE TO APPLICANTS AND AEC REVIEWERS TO PROVIDE FOR MORE ORDERLY REVIEW PROCESS	14
	Guidance to applicants	14
	Efforts to develop better guidance	15
	Information missing from applica- tions	16
	Conclusions	21
	Recommendations	22
	Need for better training and guidance for AEC reviewers	24
	Training of persons responsible for reviewing applications	24
	Guidance provided to persons re- sponsible for reviewing applica- tions	26
	Conclusions	33
	Recommendations	33
3	NEED FOR BETTER MANAGEMENT CONTROLS TO IMPROVE EFFICIENCY OF REVIEW PROCESS	35
	Inadequate documentation for effective management analyses	35
	Need for improved procedures for sched- uling and controlling progress of re- view process	39
	Conclusions	40
	Recommendations	40
4	NEED TO MAKE GREATER EFFORTS TO DEVELOP AUTOMATED SYSTEMS TO ASSIST IN THE REVIEW OF APPLICATIONS	42
	History of the CHORDS project	43

CHAPTER		Page
	Conclusions	50
	Recommendations	50
5	COMMENTS CONCERNING PROCEDURES FOR IDENTIFYING AND RESOLVING SAFETY QUESTIONS REQUIRING RESEARCH AND DEVELOPMENT EFFORTS	52
	AEC-supported research and development efforts not identified during safety review	53
	Lack of standard procedures for evaluating topical reports	58
	Recommendations	60
6	ADEQUATE RESOURCES NOT DEVOTED TO IMPROVING EFFICIENCY OF REVIEW PROCESS	62
	Recommendation	65
7	SCOPE OF REVIEW	66

APPENDIX

I	Letter of June 18, 1971, from the Chairman, Joint Committee on Atomic Energy, to the General Accounting Office	67
II	Letter dated December 15, 1971, from the Director of Regulation, Atomic Energy Commission, to the General Accounting Office	69

ABBREVIATIONS

ACRS	Advisory Committee on Reactor Safeguards
AEC	Atomic Energy Commission
CHORDS	Computer Handling of Reactor Data-Safety
DRL	Division of Reactor Licensing
DRS	Division of Reactor Standards
GAO	General Accounting Office
RDT	Division of Reactor Development and Technology

COMPTROLLER GENERAL'S REPORT TO
THE JOINT COMMITTEE ON ATOMIC ENERGY
CONGRESS OF THE UNITED STATES

MANAGEMENT IMPROVEMENTS NEEDED IN
THE REVIEW AND EVALUATION OF
APPLICATIONS TO CONSTRUCT AND
OPERATE NUCLEAR POWER PLANTS
Atomic Energy Commission B-127945

D I G E S T

WHY THE REVIEW WAS MADE

At the request of the Chairman, Joint Committee on Atomic Energy, the General Accounting Office (GAO) reviewed the procedures followed by the regulatory staff of the Atomic Energy Commission (AEC) in processing applications for the construction and operation of nuclear power plants. (See app. I.)

Because of the growth of the nuclear industry, the application work load and the time required for the technical review and evaluation of applications have increased substantially in recent years. (See p. 11.)

As directed by the Atomic Energy Act of 1954, AEC licenses the construction and operation of nuclear power plants to ensure that they will not cause undue risk to public health and safety.

FINDINGS AND CONCLUSIONS

Guidance to applicants and AEC reviewers

AEC established a separate division to place increased emphasis on the development of criteria, standards, and codes for nuclear power plants. In practice, however, the division has spent a substantial part of its time reviewing individual applications. Progress in developing improved guidance has been limited. (See p. 15.)

AEC regulations broadly describe the technical information required to be included in an application. Although various forms of guidance have been provided to applicants, including a guide for the organization and content of safety analysis reports, AEC has not established a standardized application format.

It is usually necessary for AEC to request a great deal of information from applicants to supplement the data included in their applications. Substantial delays are experienced in completing the review process until the missing information has been provided.

GAO believes that the efficiency of the review process could be improved by establishing more specific requirements as to the type, depth, and format of information to be included in applications. This would minimize the amount of missing information and would facilitate the identification of missing items by the review staff. (See p. 16.)

AEC uses highly qualified, professionally trained persons having extensive experience in the nuclear industry to review and evaluate applications. AEC, however, has not provided a formal training program and has not developed written instructions for its reviewers to promote systematic, consistent, and orderly reviews. (See p. 24.)

AEC's Division of Reactor Licensing has recognized the need for a standardized safety review and evaluation plan to:

- Provide a systematic, consistent, and orderly approach to be applied in the review of applications.
- Document the basis for acceptance of each of the safety-related elements to be evaluated, to ensure a uniform and consistent approach to licensing.
- Document the internal procedures to ensure that decisions required on unusual problems associated with applications are brought to the attention of the appropriate level of management.

Only one person has worked on the development of such a plan, however, and, due to his other responsibilities, very little work has been performed on the plan since March 1971. (See p. 27.)

One regulatory official, who has the specific responsibility for planning and directing the performance of technical reviews and evaluations of site and radiological aspects of applications, informed GAO that, because of an increase in work load and because of staff limitations, his group was not reviewing certain assigned areas as extensively as he believed desirable.

AEC advised GAO that the areas referred to related to certain pending requirements and that safety reviews had been fully adequate to ensure that current requirements were being met. AEC plans to obtain adequate staff to meet the increased work load expected to result from the new requirements. (See p. 30.)

Documentation and scheduling

AEC has established only limited requirements for documentation of the scope and depth of work performed by reviewers, the bases for conclusions reached, and the extent of management involvement in the review process. As a result little documentation is available to enable AEC management to analyze the scope and depth of work performed by different reviewers on similar matters or the causes of internal problems encountered in the review process. Although established schedules frequently were not met, there was no documented evidence of efforts by AEC management to analyze the causes of the delays. (See p. 35.)

Need for greater efforts to develop automated systems

AEC has made one attempt to develop a broad-based automated system to assist in the review of applications. The project was started in January 1967 and

was terminated in June 1971 after management problems were encountered. About \$1.1 million was spent on the project. According to AEC officials the computerized data developed has not been used in the review and evaluation of applications.

The former Director of Regulation informed GAO that the project had been terminated because it was doubtful that the objectives could be achieved and because increased in-house manpower resources could not be allocated to the project. In view of the general agreement among AEC officials as to the need for automated techniques to improve the efficiency and timeliness of reviews of applications, regulatory management should have taken additional steps to provide the resources needed and to resolve the problems that prevented the successful development of the automated system. (See p. 42.)

Research and development

GAO examined into the procedures followed by AEC in identifying research and development efforts needed to resolve safety questions related to proposed nuclear power plants and in determining that research and development programs had been completed successfully prior to issuance of operating licenses. Comments concerning these matters begin on page 52.

AEC does not have a formal system for reviewing and evaluating topical reports submitted in support of applications, which, among other things, describe the results of research and development programs. AEC should develop a system providing for the documentation of each review and evaluation of a topical report in a manner that clearly indicates the areas in which the conclusions reached in the report are supported adequately and the areas in which they are not. By this means persons responsible for evaluating applications could readily determine during their review the reliability of the reports. (See p. 58.)

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The need for additional guidance, procedures, and techniques to improve the efficiency of the review process has been recognized by the AEC regulatory staff, but actions have not been taken or have not been adequate to effect needed improvements. GAO believes that the primary reasons for this situation are as follows:

- AEC's regulatory management did not give priority to improvement of the review and evaluation process but concentrated its available resources on the review of individual cases.
- AEC's regulatory management did not request specific resources for the express purpose of developing and effecting improvements in the review process.
- AEC did not establish an effective, independent group to conduct management reviews of regulatory staff activities. (See p. 62.)

A sharp increase in the number of applications began in fiscal year 1966. For fiscal years 1966 through 1971, an average 18.3 applications were received annually compared with an average 4.3 applications annually for fiscal years 1960 through 1965--a 325-percent increase.

Despite the rising work load, no significant increase in regulatory staff levels occurred prior to fiscal year 1967. As of June 30, 1971, however, the overall regulatory professional staff had increased by 92 percent over the 1967 level. The number of professional staff members in the two divisions mainly responsible for the review of applications had increased by 171 percent. Because of the increase in work load, regulatory management has elected to use the additional resources primarily to review individual applications rather than to effect needed management improvements. (See p. 63.)

Three divisions participate in the review of applications. In November 1971 AEC appointed a Deputy Director of Regulation for Reactor Licensing to supervise regulatory staff review of licensing activities. The establishment of this position should strengthen overall management of the review process and should provide improved capability:

- To identify overall financial and personnel needs with respect to the licensing process and to ensure that such needs are brought to the attention of the Director of Regulation.
- To allocate staff resources in the most appropriate manner, considering overall staff availability.
- To establish and effect uniform procedural controls and to improve communications among and within the groups involved in the review process.
- To develop procedures for making needed management analyses of the various steps of the review process, including those which presently cross organizational lines.
- To ensure that actions are taken when needed to improve the overall review process. (See p. 65.)

RECOMMENDATIONS OR SUGGESTIONS

GAO made a number of recommendations to AEC to improve the efficiency of the application review process. (See pp. 22, 33, 40, 50, 60, and 65.)

AGENCY ACTIONS AND UNRESOLVED ISSUES

AEC expressed general agreement with GAO's recommendations and indicated that actions had been initiated or planned to improve the efficiency of the review process. (See pp. 22, 34, 41, 51, 61, and 65.)

CHAPTER 1

INTRODUCTION

Under the Atomic Energy Act of 1954, as amended, AEC licenses the construction and operation of nuclear power plants. AEC's licensing activities are carried out under the Director of Regulation who is responsible for ensuring that the construction and operation of nuclear facilities and the licensed use of radioactive materials will not result in undue risk to the health and safety of the public.

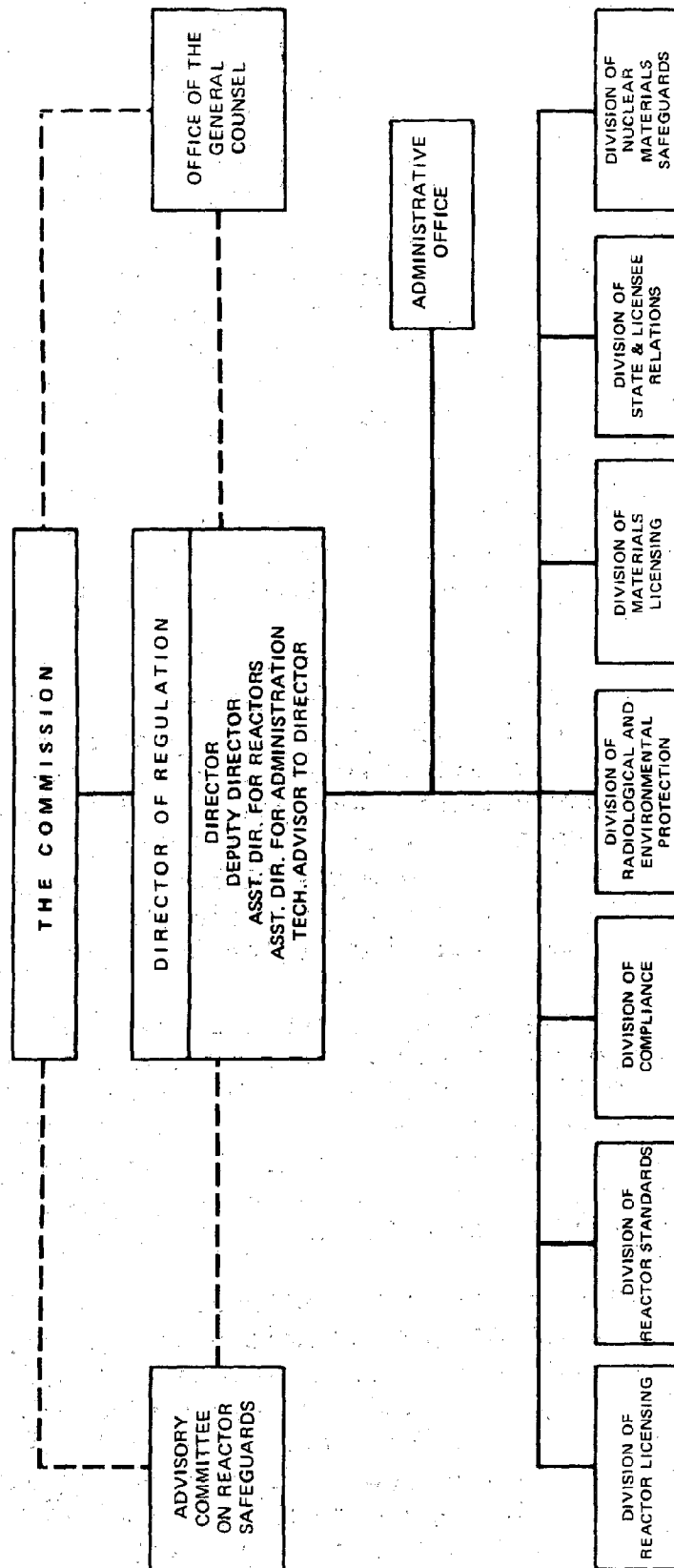
In fiscal year 1971 AEC received a total appropriation of about \$2.3 billion, of which about \$14 million was spent in the regulatory program to carry out regulatory functions and responsibilities.

Within the regulatory organization of AEC (see organization chart on p. 6), the primary responsibility for reviewing, processing, and evaluating applications for permits to construct nuclear power plants and licenses to operate them has been placed in the Division of Reactor Licensing (DRL). The review and evaluation performed by DRL is directed toward the health and safety aspects of the design, location, and operation of the nuclear plants.

The safety aspects of a proposed power reactor are reviewed by the Advisory Committee on Reactor Safeguards (ACRS), in addition to DRL, prior to issuance of a construction permit or an operating license. ACRS, consisting of a maximum of 15 members, is a committee established by the Congress and is statutorily required to conduct a safety review of reactor applications.

The decision to issue a construction permit is made only after a public hearing is held under the direction of a three-member atomic safety and licensing board composed of two technical experts and one lawyer who acts as chairman of the board for the hearing. Members of the board are appointed by AEC from private life or from AEC or other Federal agencies. With respect to the issuance of an operating license, a hearing is required to be held only if the issuance of such a license is contested or if AEC so directs.

REGULATION ORGANIZATION



(As of November 1, 1971)

DESCRIPTION OF INTERNAL APPLICATION REVIEW PROCESS

The licensing process begins when an application for a construction permit or an operating license is filed with AEC. The application must cover, among other things, the financial qualifications of the applicant, the design of the facility, and a safety analysis report. The safety analysis report discusses various accident situations and the engineered safety features which will be provided to prevent accidents or, if they should occur, to mitigate the consequences of such accidents.

Under the National Environmental Policy Act of 1969, an environmental impact report also must be submitted with each application.

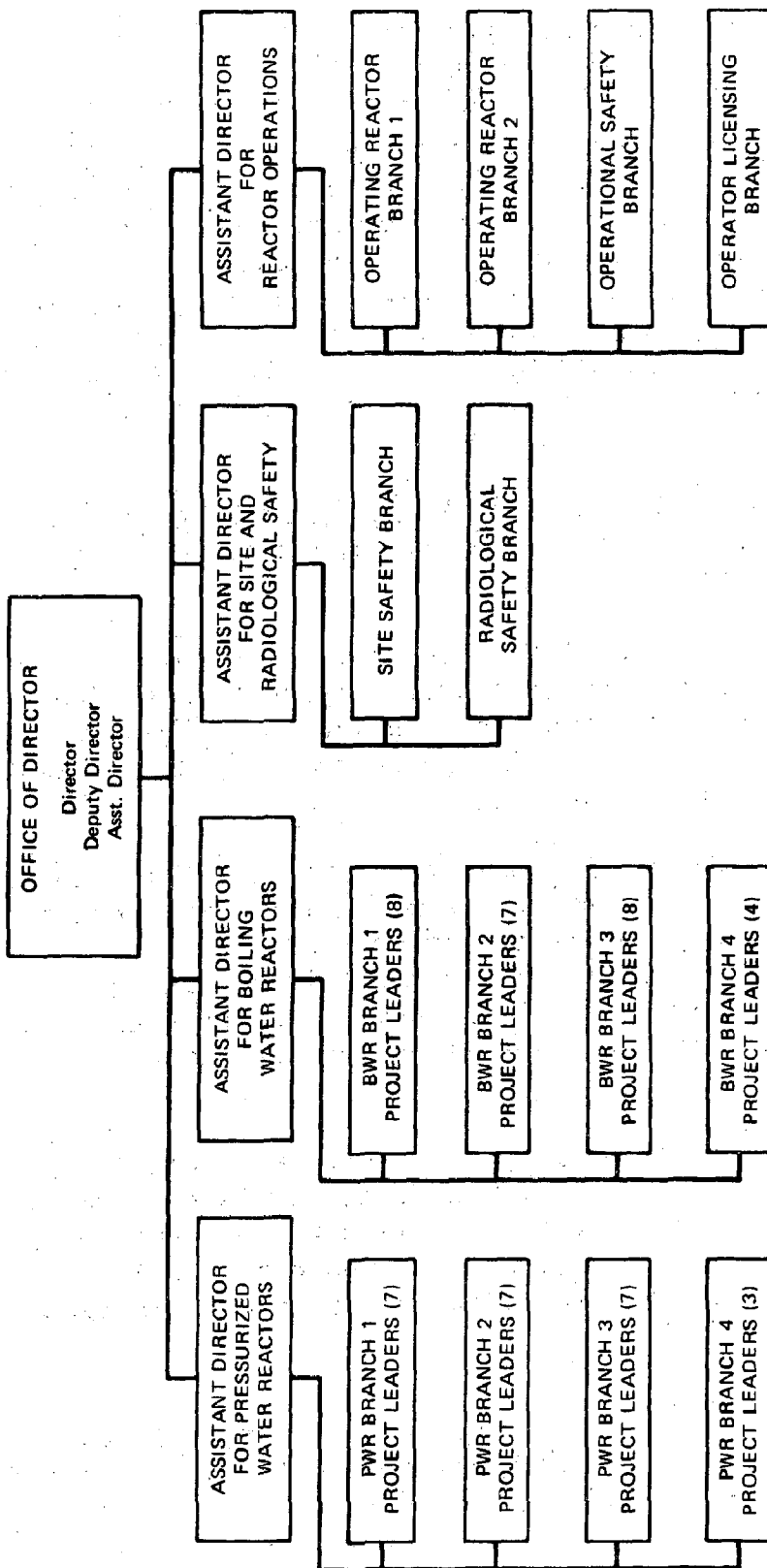
AEC advises ACRS when it receives an application, and ACRS assigns a subcommittee representing various technical disciplines to study the application. This subcommittee studies the application concurrently with the review by the AEC regulatory staff.

The organizational structure of DRL is shown on page 8. Within DRL the overall responsibility for conducting and coordinating the review of each application is assigned to a project leader.¹ The project leader is required to prepare a review plan which identifies the areas to be reviewed, the organization responsible for the review of each area, and the review schedule.

Although the project leader has overall responsibility for the review, the review actually is performed by many persons within several regulatory divisions and by outside consultants. The respective responsibilities of these organizations in the review process are summarized below.

¹As of November 1971 there were 51 project leaders in DRL responsible for reviewing applications for construction and operation of nuclear power plants.

DIVISION OF REACTOR LICENSING ORGANIZATION



Numbers in parentheses indicate number of project leaders in that branch as of November 1971.

Division of Reactor Licensing--Certain aspects of the review are performed directly by the project leader. In addition, the Assistant Director for Site and Radiological Safety is responsible for the safety review and evaluation of certain aspects of proposed sites for nuclear facilities and their radiological systems and components as well as proposed programs and limits for facility operation and control. His group (the DRL site group) reviews such items as population distribution, site meteorology, effluent monitoring, radioactive waste controls, and radiological consequences of potential accidents.

Division of Reactor Standards (DRS)--This division provides technical assistance to DRL by analyzing and evaluating the electrical, mechanical, structural, and material components and systems of the proposed nuclear power plant as well as the geological and hydrological aspects.

Division of Radiological and Environmental Protection--This division is responsible for administering the regulations governing the implementation of the National Environmental Policy Act of 1969 (42 U.S.C. 4321) and the Water Quality Improvement Act of 1970 (33 U.S.C. 1151) for all AEC-licensed activities. This responsibility includes the review, evaluation, and processing of the environmental impact reports submitted with applications for licenses to construct and operate nuclear facilities and the preparation of environmental impact statements.

We did not examine into the aspects of the review of applications related to responsibilities imposed on AEC by the National Environmental Policy Act and the Water Quality Improvement Act of 1970 because, due to a recent court decision (see p. 12), significant changes were in process in the policies, procedures, and practices under which these responsibilities were to be carried out.

Consultants--During each review the regulatory staff utilizes the capabilities of private firms and other Government agencies as consultants to review portions

of applications for which the staff does not have the in-house expertise. These reviews relate generally to site geology, meteorology, and seismology and to the seismic design of the reactor. The regulatory staff also has arranged to use, as needed, specific employees of AEC's national laboratories or of other Government agencies to review unique aspects of individual applications.

The initial efforts by these various organizations are directed toward reviewing and evaluating those sections of an application for which they are responsible and identifying the additional technical information needed to permit them to complete their evaluations. AEC regulations describe the broad technical information required in an application. In practice, however, AEC has found that additional technical information is needed and must be requested from the applicant.

This additional information is requested from the applicant through a series of formal questions. The replies received from the applicant become amendments to its original application. Generally several sets of questions must be sent to the applicant before all the technical information needed to complete the evaluation process is received. The evaluation of the application continues during this question-and-answer process; however, AEC has stated that the missing information, when supplied, may necessitate reevaluation of much of the previously submitted material.

When answers to the final set of questions have been received and evaluated, the various organizations involved in the review and evaluation process are in a position to develop their final reports. These reports are consolidated by the project leader into a final report to ACRS that presents DRL's evaluation of the safety aspects of the proposed nuclear power plant.

ACRS considers the applicant's safety analysis report, together with the evaluation prepared by DRL. Representatives of the applicant; members of the technical staffs of DRL and DRS; and, when necessary, AEC consultants meet with ACRS to deal with questions that arise during ACRS' review. When ACRS reaches a conclusion as to the safety aspects of

the proposed reactor, it reports its views to the AEC Commissioners. After the ACRS report has been received, DRL prepares an evaluation of the safety aspects of the proposed reactor that is made available to the public. This evaluation takes into account the recommendations and advice of ACRS.

The above discussion relates to the formal steps in the licensing process; however, during the course of the entire review process, there are many meetings with an applicant as well as with ACRS for the purpose of seeking additional information and clarification on the many technical matters involved in approving a license application.

The following table, which was prepared from DRL statistics, shows the average technical review time for construction permits and operating licenses for commercial nuclear power plants issued during fiscal years 1967 through 1971.

<u>Average Technical Review Time for Construction Permits and Operating Licenses</u>						
<u>Fiscal year</u>	<u>Construction permits</u>			<u>Operating licenses</u>		
	<u>Number</u>	<u>Elapsed time from</u>		<u>Number</u>	<u>Elapsed time from</u>	
		<u>receipt of application to</u>			<u>receipt of application to</u>	
		<u>Report to</u>	<u>Public Safety</u>		<u>Report to</u>	<u>Public Safety</u>
		<u>ACRS</u>	<u>Evaluation Report</u>		<u>ACRS</u>	<u>Evaluation Report</u>
		<u>(months)</u>			<u>(months)</u>	
1967	8	7.0	7.7	2	9.5	10.5
1968	10	8.7	9.7	1	15.5	19.7
1969	12	10.2	11.5	1	22.5	23.0
1970	9	14.5	15.9	2	19.0	20.4
1971	6	14.0	16.2	5	17.5	21.3

INCREASE IN LICENSING WORK LOAD

The role of nuclear reactors in the production of electricity is growing rapidly. In the last several years, there has been substantial growth in the size and number of nuclear power plants being constructed and operated for the production of electrical energy. Correspondingly there has been a significant increase in the number of license applications under review by AEC and in the manpower resources used to perform the review.

As of June 30, 1971, AEC had 48 applications under review--21 for construction permits and 27 for operating licenses. The following graphs show (1) the growth in applications received and under review from fiscal year 1960 through fiscal year 1971 and (2) the staff increases in DRL and DRS (the two divisions primarily involved in reviewing and evaluating license applications) from fiscal years 1965 through 1971.

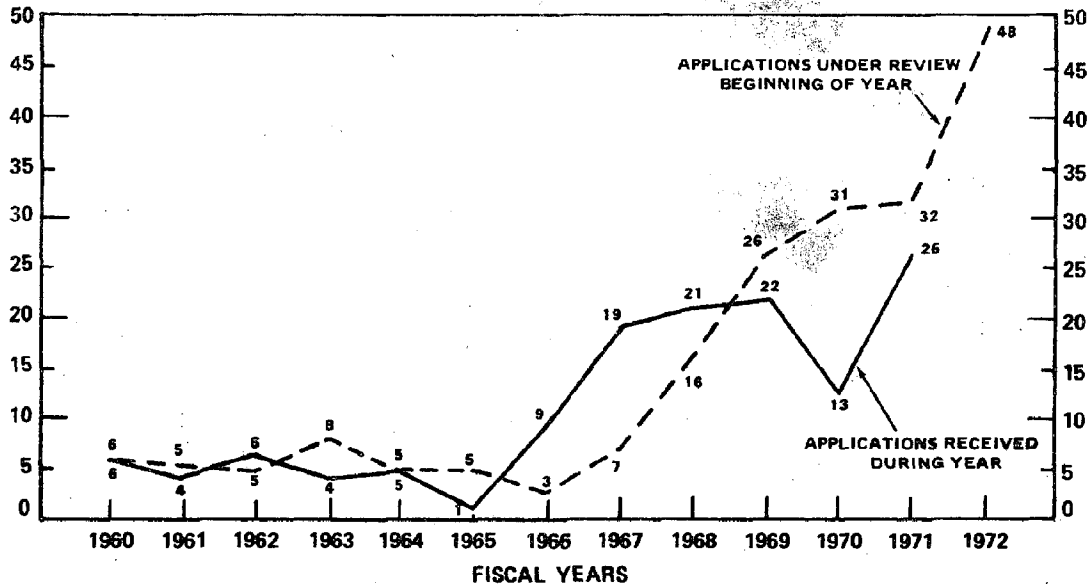
As of October 1971 DRL's estimates of the future work load showed that 136 applications were expected to be received between July 1, 1971, and June 30, 1977.

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Under the provisions of the National Environmental Policy Act of 1969 and the Water Quality Improvement Act of 1970, AEC is required to review license applications from an environmental as well as a safety standpoint. Until recently AEC sought advice on environmental questions from the appropriate Federal and State agencies; however, a recent court ruling stated that AEC had failed to appropriately implement the National Environmental Policy Act and that AEC must conduct its own investigation of all environmental aspects of commercial nuclear facilities and must make its own judgments on all environmental questions, even when a plant is in compliance with other Federal, State, or local environmental standards. This decision has had a significant impact on the work load of AEC's regulatory staff.

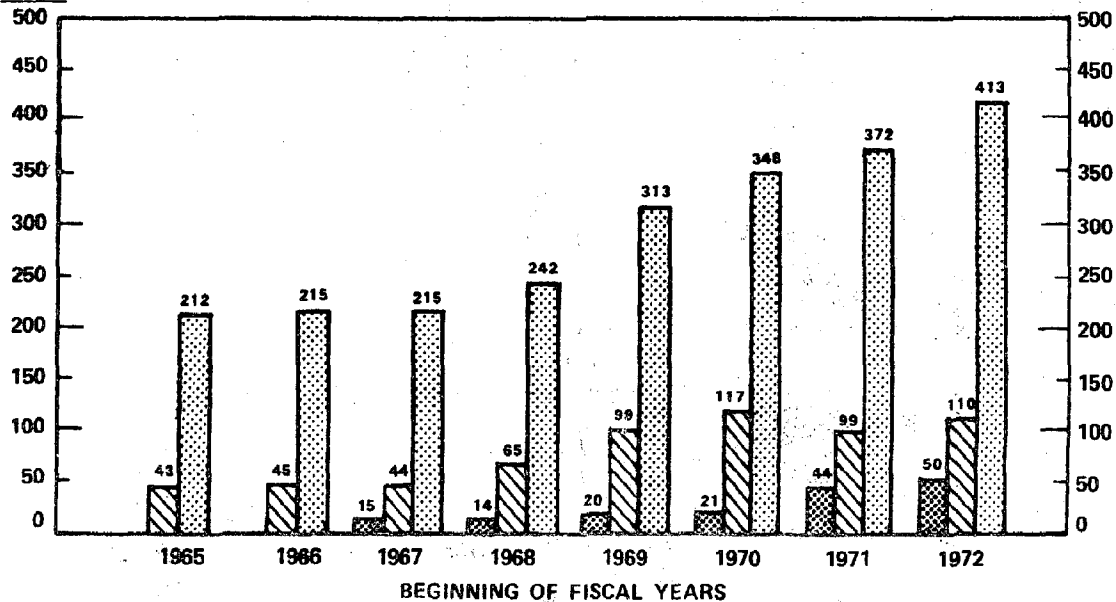
INCREASE IN APPLICATION WORK LOAD (CONSTRUCTION PERMITS AND OPERATING LICENSES)

APPLICATIONS



INCREASE IN PROFESSIONAL MANPOWER

STAFF



LEGEND

- DRS (ESTABLISHED FEBRUARY 1967)
- DRL
- REGULATORY

CHAPTER 2

NEED FOR IMPROVED GUIDANCE TO

APPLICANTS AND AEC REVIEWERS

TO PROVIDE FOR MORE ORDERLY REVIEW PROCESS

In our opinion, AEC should provide improved guidance to applicants for licenses to construct and operate nuclear power plants, to provide reasonable assurance that the information needed to review an application will be submitted on a timely basis and in a format designed to facilitate an orderly review. AEC should provide improved guidance also to persons responsible for reviewing applications with respect to the scope and extent of review work necessary to make decisions and the bases on which decisions are to be made.

Because adequate guidance has not been provided to applicants, delays are incurred in processing applications due to the time required to identify and obtain needed supplemental information which reasonably could have been expected to be included in original applications. In addition, because adequate guidance has not been provided to AEC reviewers, there is insufficient assurance, in our opinion, that applications receive systematic, consistent, and orderly reviews.

GUIDANCE TO APPLICANTS

In AEC's reactor-licensing process, an applicant for a construction permit or an operating license is required to provide assurance that the proposed principal design criteria encompass all those design features needed to prevent undue risk to the health and safety of the public. General guidance as to the requirements which must be satisfied by these design features is provided under the Code of Federal Regulations (10 CFR 20, 50, and 100). Part 50 includes a description of the minimum information to be included in the application and lists 64 general design criteria that must be met. The regulations do not, however, provide for a specific application format nor do they discuss the bases to be used in determining whether the 64 general design criteria have been met.

The regulations state that the general design criteria are not yet complete and that some of the specific design requirements for structures, systems, and components important to safety have not yet been suitably defined. The regulations go on to state that the omission of these specific design requirements does not relieve any applicant from considering these matters in the design of a specific facility or from satisfying the necessary safety requirements.

Efforts to develop better guidance

In an attempt to place increased emphasis on the development of guidance, AEC established the Division of Reactor Standards (DRS) in February 1967. The primary responsibility of DRS was to develop and recommend safety standards, criteria, and guides for the location, design, construction, and operation of reactors and other nuclear facilities. According to AEC the availability of acceptable standards in the areas relating to public health and safety would significantly enhance the effectiveness and efficiency of the licensing process.

As of November 1971 AEC had issued 18 safety guides, two information guides, and five other guides relating to the construction and operation of nuclear power plants. These guides are not intended as substitutes for regulations.

Safety guides are used to describe acceptable solutions to safety issues for which AEC has not yet determined that a particular solution should be made a requirement. The information guides identify technical information needed in the review of (1) primary reactor containment systems of steel construction and (2) instrumentation and electrical systems of nuclear power plants. The other guides mentioned above provide information on (1) suggested organization and contents of safety analysis reports, (2) the AEC review and inspection of preoperational testing programs and initial startup programs, (3) suggested data to be included in technical specifications, and (4) the preparation of emergency plans.

In addition to issuing these guides and the previously mentioned general design criteria, AEC has issued regulations on the quality assurance requirements to be met by

applicants; minimum requirements for emergency plans; and, most recently (June 1971), two generally accepted codes and standards which must be met in the construction of a reactor. These are the first requirements that nuclear power plants be constructed in accordance with generally accepted codes and standards. Also AEC has issued for public comment proposed regulations on fracture toughness requirements, reactor vessel material surveillance program requirements, and reactor containment leakage testing.

The Special Assistant to the Director for Standards and Guides, DRS, advised us that there was a need for 66 more safety guides; about 30 more information guides; and thousands of codes, standards, and criteria. During our discussions with industry representatives, we were told that the general design criteria were too vague and that, in their opinion, there was a need for guidelines to be developed which would set specific parameters on what would be acceptable to AEC.

The Special Assistant to the Director for Standards and Guides, DRS, advised us that greater progress had not been made in developing better guidance for applicants because a substantial portion of DRS' time had been spent in providing technical assistance to DRL on a case-by-case basis. He provided us with an analysis of DRS professional staff time for fiscal year 1971, which showed that only 20 percent of DRS' time was spent in developing standards, criteria, and guides. The Assistant Director of Regulation for Reactors advised us that, although the development of standards, criteria, and guides was important, regulatory top management had decided that individual case-by-case reviews had precedence over the development of such guidance.

Information missing from applications

AEC has been critical of applicants for (1) not submitting complete applications which provide all the information required by the regulatory staff to evaluate the safety of the plant, (2) not organizing their applications so that they deal adequately with all necessary topics, relating the proposed design to previously approved designs and to AEC guides and criteria and industrial codes and standards, and (3) not treating significant areas in enough depth.

AEC, however, has neither developed a standardized application format nor issued specific requirements as to the information that must be included in an application to enable it to make its analysis.

The fact that AEC has not established more specific requirements as to the content and format of applications has resulted in several problems which, in our opinion, have contributed to the delays incurred in the review process. Applications normally consist of four to six volumes of highly technical information. The general nature of AEC's requirements for application content and the lack of a standardized application format, in our opinion, place a substantial burden on persons responsible for reviewing the applications to identify missing information on an orderly and timely basis.

In the absence of a standardized application format, the depth of coverage of similar items varies among applicants even though the potential exists for more uniform treatment. If an applicant fails to discuss a given subject in the manner or depth which AEC believes necessary, AEC must prepare questions requesting the additional or missing information needed to make its evaluation.

As discussed previously (see p. 10), several sets of questions normally are asked of applicants before complete information has been obtained. Regulatory officials have informed us that the initial set of questions usually requests missing information and that the additional sets of questions usually request supplemental information needed for evaluation purposes. Our review of four sets of initial questions showed that they included as many as 177 questions.

AEC has advised the Joint Committee on Atomic Energy that, during the initial review of an application, it is difficult to differentiate between the effort spent in identifying missing information and that spent in evaluating information since the entire application must be read and reviewed for adequacy by the project leader. AEC has advised the Joint Committee also that it is difficult to determine the number of questions which ask for missing information and the number which ask for information of an evaluation nature.

During our discussions with members of the regulatory staff involved in the day-to-day processing and reviewing of applications, however, we were provided with the following estimates with respect to the percentage of the initial set of questions which ask for missing information.

--DRL project leaders stated that between 50 and 80 percent asked for missing information.

--A branch chief in DRL's site group estimated that 80 percent of the initial questions asked for missing information.

--A branch chief in DRS stated that between 75 and 80 percent asked for missing information.

The average time between the receipt of an application and the submission of the initial set of questions to the applicant is currently about 5.5 months. The average time it takes an applicant to respond to the initial set of questions is not readily available from DRL statistics; however, for the four applications we reviewed in detail, the average time taken by the applicants to respond to the initial set of questions was about 3 months.

Therefore, assuming that an applicant takes 3 months to answer the initial questions and that the answers received are complete (which is not always the case), AEC would not have a complete application until about 8 months after its review started. AEC has stated that the missing information, when supplied, may necessitate reevaluation of much of the previously submitted material and may result in an overall delay in the review. In April 1970 the Assistant Director, DRL, in a memorandum commenting on the need to reduce the elapsed time and man-hours required to perform a safety evaluation, advised the Director, DRL, that it appeared that a considerable amount of time was being lost because information was missing from applications.

In an attempt to provide better guidance to applicants and the regulatory staff and to thereby shorten the application review time, DRL compiled a list in 1968 of regulatory staff questions asked on 13 construction permit applications during fiscal years 1965 through 1968, covering a total of

16 boiling-water nuclear power plants. The DRL official who compiled the list of questions made the following observation.

"*** the question lists and the amendments required to answer them have gotten longer rather than shorter which must mean either (or both) that applicants for new construction permits are not fully responsive to information requested of previous applicants or that staff information requests present a moving target propelled both by system design changes and by new concerns of the staff and ACRS."

The list of questions compiled by DRL has never been disseminated to prospective applicants. The Director, DRL, advised us that the list had not been distributed because (1) a private firm had prepared a similar listing which it planned to sell to prospective applicants, (2) many of the questions were no longer applicable, and (3) questions were being asked which were not in the list.

In July 1971 the Director, DRS, proposed the development of a new series of guides, called information guides, which would consolidate many of the questions asked repeatedly of applicants in individual licensing cases. In November 1971 two such guides were issued to provide applicants with additional guidance with the expectation that the amount of supplementary information requested by AEC and subsequently submitted by applicants could be reduced substantially. It should be noted, however, that these guides are not requirements and are intended only to provide guidance to applicants. Also these two guides relate primarily to aspects of the review for which DRS is responsible.

We found that questions in the 1968 list compiled by DRL still were being asked of applicants during fiscal years 1970 and 1971. For example, the following question appeared in the 1968 list and a similar question appeared in the question lists we reviewed relating to four applications reviewed by DRL during 1970 and 1971.

"What requirements will be imposed to insure that the reactor protection equipment and equipment for

engineering safety features will withstand maximum prevailing environmental conditions throughout life expectancy during normal station operations and perform as required when called upon in the abnormal environmental conditions that can last during and after postulated accidents?"

Our review also showed that the applicants either were not following the existing guidance provided by AEC or were not discussing certain topics as thoroughly as AEC desires. For example, AEC's guide for the organization and contents of safety analysis reports states that, with respect to the site and adjacent areas, an applicant should provide information relating to:

"The nature, extent, and basis of control exercised by the applicant over the site, including ownership, and, if applicable, leasing arrangements, and arrangements with respect to fencing, posting, patrolling, and similar control mechanisms."

Yet the question lists submitted to the four applicants mentioned previously contained the following question or a similar question requesting the same data.

"Describe what provisions will be made to ensure plant security from unauthorized entry both during construction and operation. Indicate the extent of perimeter fences, lighting, guards, employee screening procedures, visitor control, control of containment access, and other site surveillance methods."

We discussed with AEC officials the reasons why greater efforts had not been made to improve the guidance to applicants by developing more specific requirements as to the format and contents of applications.

The Director, DRL, informed us that DRL had not developed such improved guidance because (1) the design of reactors had not been standardized and (2) DRL could not be certain that applicants would use it, since applicants currently were not using the guidance available to them on the preparation of applications.

Conclusions

The preparation of an application to construct or operate a nuclear power plant is a time-consuming and complex endeavor. The great volume of technical data included in such applications places a substantial responsibility on the AEC reviewers to ensure that all relevant information has been included in the applications and to identify missing information. Also the extent to which missing information is identified during the review process can have a substantial bearing on the orderliness with which the reviews can be carried out.

AEC has recognized the need for, and has been attempting to provide, additional guidance to applicants. In view of the substantial volume of guides, codes, standards, and criteria still needed, however, it appears that, even if AEC devotes priority effort to their development, the question-and-answer phase will continue to involve a considerable amount of time in the overall review process.

When it is necessary to request a great deal of information from applicants to supplement the data included in their original applications, substantial delays can be experienced in completing the review process until the missing information has been provided. Thus, to the extent that actions can be taken to (1) provide greater assurance that needed information will be included in the original application and (2) provide timely identification of missing information, the review process should be expedited.

In our opinion, the general nature of the requirements placed on applicants by AEC tends to limit the extent to which these objectives can be met. Although we recognize that the development of nuclear power plants involves a constantly evolving technology and that all the information needed to support an application cannot be identified specifically in advance, we believe that the efficiency of the review process could be improved by the establishment of more specific requirements as to the type, depth, and format of information to be included in applications.

Specifically we believe that AEC should develop a standardized application format and numbering system which, while

providing the applicant with the flexibility necessary to include all relevant information, will provide for the inclusion of information, under uniformly numbered paragraphs, known to be needed by the regulatory staff.

The application format should discuss under each numbered paragraph the specific information which AEC requires to be included at that point. In this manner application reviewers will be able to examine specific sections of the application to see whether required information has been included and, if the information has not been included, to issue requests for it promptly without needing to determine whether the information is included at some other place in the application.

We believe that this type of procedure would provide applicants with a disciplined approach under which particular subjects would be discussed at the appropriate place in an application and at the same time would provide the regulatory staff with an orderly means of identifying missing information on a more timely basis than presently can be done. In addition, such a procedure would enable DRL's preliminary review of an application to be directed toward the principal safety issues at an early date instead of toward identifying information missing from the application.

Recommendations

To improve the efficiency of the licensing process, we recommend that AEC

- develop a standardized application format having specifically numbered sections which designate the desired information to be included therein and
- determine the manpower resources needed to develop guides, codes, standards, and criteria and, to the extent practicable, allocate such resources to this task on a full-time basis.

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In commenting on our draft report, AEC, in a letter dated December 15, 1971 (see app. II), stated that it was in

general agreement with our recommendations and that actions responsive to the recommendations had been initiated or planned. AEC pointed out that, in its opinion, the difficulties faced by the regulatory staff in dealing with the many unique safety problems of a complex, rapidly growing, new industry and its broadened responsibilities had compounded the task of accomplishing some of the finer management improvements and techniques that are important in expediting the licensing process.

Specifically, with respect to our recommendations that AEC develop a standardized application format and determine the manpower resources needed to develop guides, codes, standards and criteria, AEC has advised us:

- That work is under way to improve and expand guidance for applicants through the development of a standardized application format.
- That a determination has been made not to accept applications in the future until they are reasonably complete.
- That full-time manpower commitments to the standards area have been made and that additional staffing needs are being identified.
- That other ways and means of intensifying efforts in the standards field and of providing for effective management of the overall standards effort are being explored.

NEED FOR BETTER TRAINING AND GUIDANCE FOR AEC REVIEWERS

The safety review of applications for construction permits and operating licenses requires a systematic and disciplined approach to properly plan, carry out, and control the scope and depth of evaluation. AEC, however, has neither provided a formal training program for the persons responsible for reviewing applications nor developed written instructions for reviewers to promote the systematic, consistent, and orderly review of applications.

Training of persons responsible for reviewing applications

The principal responsibility for conducting and coordinating the technical review of an application rests with the DRL project leader. As of November 1971, 51 project leaders in DRL, seven professional employees in DRL's site group, and 35 professional employees in DRS were involved in the application review process. We were informed that the professional staff members in DRL and DRS generally had many years of experience as design engineers in the nuclear industry prior to being hired by AEC. Also about 97 percent of them have bachelor's degrees or advanced degrees in engineering.

DRL conducts no formal training programs for the project leaders but rather provides them with informal training when they are assigned to a particular branch. DRL officials have informed us that initially the branch chief, or a senior project leader designated by the branch chief, provides the project leaders with information concerning the conceptual framework under which a review is carried out.

We have been informed by the Deputy Director, DRL, that this training varies by branch and depends on (1) the branch chief's individual ideas of what the training should be, (2) the work load of each branch, and (3) the capabilities of the individual project leaders assigned to each branch.

We have been told that a new project leader generally is assigned to work with, and under the close supervision of, an experienced project leader or branch chief for about

6 months to a year, after which, on the basis of the branch chief's evaluation of the project leader's capabilities, the project leader is assigned full responsibility for review of applications. Two instances were brought to our attention, however, in which new project leaders were assigned primary responsibility for the review and evaluation of an application within a month after being employed by AEC. We were advised that these persons were qualified to carry out their assignments and that these actions were considered appropriate under the circumstances.

The training given to the reviewers in DRS and in the DRL site group is almost identical to that given to project leaders. New reviewers in the site group are given a brief orientation and then are assigned to a review under the supervision of an experienced reviewer. In DRS new reviewers are assigned to review general problems applicable to more than one application for about 3 months, after which they are assigned to reviewing individual applications.

A project leader informed us that in August 1968 he proposed the establishment of a formal DRL staff orientation program which would have consisted of an explanation of (1) the regulatory review process, (2) the organization and functions of each regulatory division, and (3) the role of ACRS and the atomic safety and licensing boards. He stated that he had received no comments on his proposal other than the comment that it would be considered. Also he advised us that, in his opinion, such a program currently was needed in DRL.

During our discussions with other regulatory officials, we were advised that a formal orientation program for new employees would be desirable. A branch chief in DRL advised us that, in his opinion, it would be beneficial to (1) hold a seminar for new employees at which representatives of all organizations participating in the licensing review process would provide the new employees with a conceptual picture of the entire review and (2) periodically conduct seminars on regulatory policy matters for all DRL employees. An assistant director in DRS expressed the belief that a formal orientation program for new employees, covering the administrative aspects of the licensing process and regulatory policies and procedures, would be helpful.

Guidance provided to persons
responsible for reviewing applications

The problems associated with the lack of a formal training program are compounded by the fact that the Director of Regulation has issued no formal instructions, regulations, or other procedural documents to the regulatory reviewers that would provide guidance as to the scope and depth of the review, the specific determinations to be made during the review of an application, or the bases upon which these determinations should be made. The reviewers, of course, have available, and use, the guidance made available to applicants, such as the regulations and safety guides.

DRL has not issued any overall instructions or an operating manual to assist reviewers in the review of applications. Although some specific guidance has been provided, relating to the review of such areas as quality assurance and technical specifications, there are many areas in which DRL has provided no written instructions concerning the manner in which a review should be conducted. The Director, DRL, informed us that there was no single list available of all guidance that had been given to reviewers. In October 1971 the Assistant Director, DRL, advised us that the depth of the review and evaluation generally depended on the project leader.

The Director, DRS, has not provided any written guidance to his reviewers, other than certain draft safety guides and memoranda discussing specific aspects of the safety review and evaluation of applications. We were informed that there was no listing of the guidance available to DRS reviewers and no manual containing guidance to ensure consistency in the scope, depth, determinations, and bases for such determinations for all aspects of the review performed by DRS.

Regulatory officials advised us that the reviewers had available the results of all previous reviews, the minutes of task force meetings, management directives from the Director of DRL, a listing of the ACRS concerns, hearing transcripts, and atomic safety and licensing board decisions. In addition, we were told that the professional judgment of each of the 58 reviewers in DRL (51 project leaders and seven site group reviewers) and of the 35 reviewers in DRS

was relied upon to a large extent to ensure that reviews of applications were conducted appropriately.

Regulatory officials pointed out, however, that the work of the reviewers was supervised closely by branch chiefs and that the results of their work, including questions to applicants and reports on their evaluations, were reviewed by various levels of management to ensure the adequacy and completeness of the review. In addition, AEC officials pointed out that reviews by the regulatory staff were subject to detailed scrutiny and evaluation by the ACRS full committee and subcommittees and by the atomic safety and licensing boards.

The need for the development of better guidance for reviewers has been recognized within DRL for some time. A branch chief in DRL advised us that several years ago he proposed that an evaluation handbook be developed which would include a collection of information and current instructions on how to review, evaluate, and process an application from a technical point of view. Such a handbook would help to ensure consistency and uniformity of review and adherence to DRL policies and procedures. The branch chief informed us that the idea had been well received by DRL management and that he had been told that he could compile such a handbook when he found the time. He stated that he had not had the time to develop such a handbook.

In an October 1969 memorandum, DRL discussed plans for developing a standardized safety review and evaluation plan. DRL stated that the development of the plan should be a high-priority task and that it would be necessary for management to require that those persons assigned to develop the plan devote a given fraction of their time to the effort.

The objectives of the standardized safety review and evaluation plan were:

1. To provide a systematic, consistent, and orderly approach to be applied by DRL employees in the review of applications.

2. To document the basis for acceptance of each of the safety-related elements to be evaluated, to ensure a uniform and consistent approach to licensing.
3. To document the internal procedures necessary to ensure that decisions required on unusual problems associated with applications are brought to the attention of the appropriate level of management.

In June 1970 the Director, DRL, informed the Assistant Director of Regulation for Reactors that the preparation of a standardized review plan or guide had been initiated. The review plan would include not only a checklist of items to be reviewed but also a statement of the safety issue associated with each item and the basis to be used for reaching a finding. He stated that:

"Progress on the guide has been slow because of the heavy case workload, the realignment of the organization, and the effort involved in documenting the basis to be used in reaching a finding. The latter requires documenting ad hoc precedents established on plants already reviewed and approved.

"In view of the above, we are currently redirecting our efforts toward the preparation of checklists. A draft checklist covering the site has been completed and draft checklists on the reactor and primary coolant system are nearing completion and should be available in the next several weeks. These checklists when complete will be assembled in a document as a single comprehensive checklist. The individual checklists are being used as the guide for developing the standard review plan."

In a memorandum dated July 8, 1970, the Director, DRL, informed his assistant directors and branch chiefs that:

"Within DRL it is essential to the proper planning of the depth and breadth of evaluation and to the supervision and management control of the safety review of reactor CP [construction permit] and

OL [operating license] license applications that check lists be used in a consistent, routine manner. The limitations of check lists in themselves, however, should be fully realized and guarded against in not restricting the scope and innovation of inquiry."

He stated that an example of a review plan and four checklists had been assembled in a notebook and that these documents were to be used during the review of applications until such time as a single, comprehensive checklist could be developed.

Our review of the notebook showed that it did not contain statements of the safety issues associated with each item or the basis to be used for reaching a finding on each item during the safety review and evaluation process. Our discussions with various project leaders revealed that some of them were not aware that this notebook existed and that none of them were using all the items in the notebook.

Various project leaders informed us that a checklist containing the criteria to be used in evaluating applications would assist them in their reviews.

AEC informed the Joint Committee on Atomic Energy in August 1971 that DRL had under development guides and checklists to help standardize the review process and to ensure completeness. The Assistant Director of DRL informed us in November 1971, however, that from October 1969 he had been the only person in DRL to work on the development of a standardized safety review and evaluation plan and checklists and that, due to his other responsibilities, very little work had been performed on the project during the past 8 months.

In the absence of more adequate guidance, decisions as to the scope and extent of reviews and evaluations to be performed must be made by the individual reviewers on the basis of their professional judgment, advice received from supervisory and management personnel, and the time available to perform the reviews.

Specifically two of four project leaders that we interviewed concerning the extent of their review efforts informed us that at times the depths of their reviews had been influenced to meet applicants' desires for achieving their scheduled construction or operation dates. The other two project leaders informed us that their reviews had not been affected by such circumstances. The Director, DRL, advised us that scheduling, assignment of priorities, and decisions on depths of reviews were management functions and that, when decisions had been made to curtail the depths of reviews, such decisions did not imply any lack in the scopes or depths of reviews necessary to ensure safety.

The Site Safety Branch, DRL, is under the Assistant Director for Site and Radiological Safety and participates in performing the site group's review of applications. The chief of that branch informed us that the reviewers in his branch had not been provided with a checklist which would define what they should consider during their reviews. He also said that the development of such a checklist was a high-priority item.

With respect to the adequacy of the site group's safety review and evaluations, the Assistant Director for Site and Radiological Safety informed us that, because of an increase in work load and because of staff limitations, his group was not reviewing certain assigned areas as extensively as he believed desirable. For example, he stated that his group was accepting the applicant's criteria and analyses for an unproven piece of equipment in the radioactive waste treatment system on the basis of discussions with the applicant rather than on the basis of a thorough review and evaluation of such equipment.

In commenting on the statement by the Assistant Director for Site and Radiological Safety, the Director, DRL, in December 1971 stated:

"The areas referred to relate to rules which went into effect in January 1971, promulgating the Commission's policy of assuring that exposures to radiation and releases of radioactivity in effluents from power reactors are kept as low as practicable. Specific numerical guidance for achieving

the 'low as practicable' goal in further limiting radioactivity in effluents was issued in proposed form in June 1971, and was still pending adoption in the rulemaking process. The increased workload in prospect due to the new requirements did not have to be accomplished immediately, and it is planned to obtain adequate staff in this area on a timely basis. Safety reviews performed to date have been fully adequate to assure that current requirements were being met.

"With regard to the acceptance of the applicant's analyses for equipment in the radioactive waste treatment system, the applicants' statements are under oath, and operational performance of the equipment is required to be within license-imposed limits."

An example of an area in which more specific guidance to reviewers would appear to be appropriate relates to the extent to which calculations included in safety analysis reports should be verified. The guide provided to applicants for the preparation of safety analysis reports states that AEC will spot-check calculations included in applications to establish the validity of the applicants' analysis and evaluation of the design of the nuclear power plant.

DRL and DRS officials advised us that no guidelines had been established to show the extent that calculations should be spot-checked. They explained that the individual reviewers, on the basis of their review of the various sections of the application, determined the depth of review necessary to establish a basis for a finding with respect to the safety of a proposed plant.

DRL project leaders and DRS reviewers told us that they made very few individual calculations for the purpose of verifying the data submitted by the applicant. We were informed that generally DRL and DRS attempted to have the applicant perform the calculations and present them to AEC.

Another example of an area in which additional guidance would appear to be beneficial involves the extent of reliance to be placed on topical reports. These reports discuss

specific technical aspects of proposed nuclear facilities, including the results of research performed by reactor manufacturers. Applicants generally make reference to topical reports to support certain portions of their safety analysis reports.

Although such reports are used in support of an applicant's analysis of the safety of a proposed reactor, we found that AEC had no formal system for approving such reports and had not provided formal guidance to reviewers as to the extent such reports should be reviewed to establish their reliability. Further, for most of these reports, we found that no guidance had been provided to reviewers as to the extent to which previous reviews of the reports in connection with prior applications may be relied upon. (Further comments on the review of topical reports are contained on p. 58.)

Our discussions with DRL and DRS reviewers and with industry representatives confirmed the conclusion that reviewers needed additional guidance for performing their reviews. Most of the reviewers we interviewed indicated that additional guidance would be helpful. Industry representatives advised us that their experience had shown that the depth of review varied depending upon the project leader assigned.

Conclusions

The review of applications for construction and operation of a nuclear power plant is a highly complex, technical undertaking involving the evaluation of a voluminous amount of information and the making of numerous determinations related to the health and safety of the public.

As of November 1971 DRL had 51 project leaders and seven site group reviewers, and DRS had 35 reviewers. The professional staff of DRL increased by about 156 percent from fiscal years 1965 through 1971, and that of DRS increased by about 257 percent from fiscal years 1968 through 1971.

We recognize that these reviewers are highly qualified, professionally trained persons having extensive experience in the nuclear industry. In our opinion, however, in the absence of providing formal training and guidance to these individuals as to the administrative aspects of the licensing process, the bases to be used in making determinations, and the depth of the review work necessary, AEC does not have adequate assurance that reviews are conducted in a systematic, consistent, and orderly manner.

In the absence of better guidance to reviewers, it appears likely that decisions as to the scope and extent of review of individual aspects of applications are made on an ad hoc basis rather than on the basis of established criteria. In our opinion, the development of improved guidance for reviewers would provide added assurance that reviews were not unduly delayed because of decisions of reviewers to make analyses in greater detail than may be required in certain cases. Such guidance would provide added assurance also that all aspects of the review were covered to the extent considered necessary by AEC management.

Recommendations

To provide greater assurance that reviews of applications are conducted in a systematic, consistent, and orderly manner, we recommend that AEC provide, on a priority basis, for the development of appropriate training and procedural guidance for reviewers that will provide, to the extent

practicable, information as to (1) the specific safety issues to be evaluated, (2) the type of evidence needed to make the evaluation, and (3) the bases for making necessary determinations. We recommend also that checklists be developed and used by all reviewers to ensure systematic consideration of all the issues pertinent to the review and approval of applications.

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AEC informed us (see app. II) that:

- It was proceeding to develop appropriate training for the regulatory staff with particular emphasis on training for reviewers.
- It would accelerate the development of appropriate checklists for reviewers that are sufficiently flexible to avoid unduly restricting the scope and innovation of review. It is planned that the procedural guidance for reviewers will include, to the extent practicable, information as to (1) the specific safety issues to be evaluated, (2) the type of evidence needed to make the evaluation, and (3) the bases for making necessary determinations.

CHAPTER 3

NEED FOR BETTER MANAGEMENT CONTROLS

TO IMPROVE EFFICIENCY OF REVIEW PROCESS

AEC has established only limited requirements for documentation by reviewers of the scope and depth of the work that they perform, the bases for their conclusions, and the extent of management involvement in the review process. As a result there is little documentation available to enable AEC management to analyze the scope and depth of review work performed by different reviewers on similar matters or the causes of internal problems encountered in the review process. Further, although established schedules frequently were not met, there was no documented evidence of efforts by AEC management to systematically analyze the causes of internal delays.

INADEQUATE DOCUMENTATION FOR EFFECTIVE MANAGEMENT ANALYSES

AEC maintains an internal docket file for all applications which have been reviewed or which are under review. We were informed by the Administrative Officer, Office of the Director of Regulation, that no formal requirements existed as to what information should be maintained in the docket file but that it was the official record of the licensing process and was intended to contain all information related to the review of applications.

Our review of the contents of several docket files showed that, in general, they contained such items as the applications and all amendments thereto, correspondence among all interested parties, minutes of meetings with applicants, reports from consultants, internal reports from AEC divisions, and final reports relating to the review.

We found that there were inconsistencies in the documentation included. In several cases information that apparently should have been included was not in the docket files. The omitted information included (1) a list of questions submitted to DRL by a DRS reviewer, (2) copies of some of the consultants' final reports, and (3) agendas and

minutes of meetings with applicants. Further the docket files generally contained no evidence to indicate the extent of analyses and evaluations made during the review, with the exception of questions sent to the applicants and the reports prepared by DRL for ACRS and the public.

The docket files we reviewed contained no records that showed the extent of management review of the work performed by the application reviewers. For example, there were no records showing the flow of questions and reports from the time they were prepared by the project leader to the time they were sent to the applicant. In the absence of such information, we could not determine the extent of management's review or the length of time involved.

In addition, the docket files we reviewed contained no records specifically designed to show the basis for determining that questions sent to the applicant had been answered satisfactorily. Although there were no requirements or procedures for routinely documenting the adequacy of applicants' responses, we noted instances in which reviewers had prepared memoranda specifically evaluating the applicants' answers to several questions. Even in cases in which the applicants' responses were formally evaluated and found inadequate, there was no formal documentation to show how questions not answered adequately were resolved subsequently.

We found that in some cases questions prepared by DRS reviewers and submitted to DRL had not been included in the formal question list sent to the applicant; however, we could not in all cases determine from available records the reasons why they had not been included. Project leaders advised us that questions from reviewers sometimes were not included because (1) the information requested already was contained in another part of the application, (2) the question was answered in another document, such as a topical report, not received by the reviewer, or (3) the question was for documentation purposes only, and the project leader believed that the question did not need to be asked.

We were advised that reviewers in DRS and in DRL's site group were not given an opportunity to concur in the final question list sent to an applicant. A branch chief in DRL's site group told us that, in some cases, questions which he

had submitted to project leaders had not been included in the list or, prior to being included, had been reworded to the extent that the questions lost their original meaning. As a result, the answers received from the applicant were not satisfactory.

The AEC reports submitted to ACRS and the public discuss numerous evaluations made and conclusions reached during the review process. The available documentation in support of these evaluations and conclusions was not consistent among project leaders.

Project leaders advised us that, although they did not fully record the scope or extent of review work performed or evidence accumulated in support of individual conclusions, they believed that the facts presented in reports to ACRS and the public logically supported the conclusions reached. The project leaders also stated that they could support their conclusions, if necessary, by reviewing the safety analysis reports, the applicants' answers to AEC questions, and other documentation maintained in the docket files.

Our review of several safety analysis reports showed that they included many calculations and results of calculations in support of the applicants' analyses. The site group in DRL maintains, for each application, a file containing records of the calculations checked during the review. When the project leader or the DRS reviewer makes or verifies a calculation, however, there is no requirement that the supporting documentation be either retained or placed in the official record.

For example, in one case a project leader retained a computer printout of a calculation he had verified although he noted that there was no requirement that he retain it. In other cases project leaders told us that any calculations they had made were in their personal records.

The Director, DRL, informed us that several years ago it was planned that there would be a backup man on each project; i.e., each project leader would have primary responsibility for one project and secondary responsibility for another project. This procedure was intended to ensure the continuity of review in the absence of the project leader having primary responsibility.

Most of the branch chiefs advised us that they did not follow this procedure because existing work-load problems would not permit the assignment of a backup man. In our opinion, the practice of not assigning backup men to each project places increased emphasis on the need for adequately documenting the scope, depth, and bases for determinations made by the project leader.

In view of the lack of documentation concerning the scope and extent of review efforts, we discussed with AEC management the methods used to determine that an appropriate evaluation and analysis had been made by the project leaders and other reviewing individuals in each case.

Branch chiefs advised us that they evaluated the work of the project leaders through their continual personal contacts, reviews of questions prepared by the project leaders, agendas, minutes of meetings with applicants, and reports to ACRS. Management officials above this level indicated that they relied primarily on the experience of the project leaders and branch chiefs, plus their own evaluations of the questions and reports, to ensure that adequate and complete reviews had been made.

NEED FOR IMPROVED PROCEDURES
FOR SCHEDULING AND CONTROLLING
PROGRESS OF REVIEW PROCESS

One of the initial steps in reviewing an application is the preparation of a review plan by DRL that contains information as to the various segments of the application to be reviewed by each participating organization and as to target dates for the preparation of questions, receipt of answers and final reports from each of these organizations, and preparation of reports to ACRS and the public. The target dates contained in the review plan are updated monthly by DRL.

Our review of several applications showed that in many cases the target dates contained in the review plan had not been met. Various regulatory officials advised us that these target dates generally were unrealistic.

We found that only limited efforts had been made by DRL management, however, to identify the causes of schedule slippages. Although some notations were made on revised schedules as to the causes of slippages, there was no documented evidence of efforts by DRL management to systematically determine where delays were occurring internally or to analyze the causes of such delays to see if management improvements could be made. As previously discussed the docket files we reviewed contained no records showing the flow of questions and reports from the time they were prepared, through the various review levels, until the time they were sent to the applicant, which precluded us from determining where bottlenecks might be occurring in the process.

DRL has stated that one of the major factors contributing to the delay in review of applications has been the lack of timely responses by applicants to AEC requests for additional information. We were informed that applicants generally were advised informally of AEC's review schedule. We noted, however, that the AEC letters submitting lists of questions to applicants provided the applicants with no target dates by which replies should be submitted.

CONCLUSIONS

In chapter 2 we discussed the need for additional guidance to persons responsible for reviewing applications as to the scope and extent of their review efforts. In this chapter we have detailed the limited documentation maintained by AEC in support of its conclusions with respect to the safety aspects of a proposed nuclear power plant.

Because (1) adequate guidance has not been provided to reviewers, (2) no type of checklist is employed consistently in making a review, and (3) there are only limited documentation requirements, it appears to us that AEC management evaluates the work of individual reviewers without sufficient documentary evidence. Also the lack of documentation on the timing of various steps of the internal review process, such as the processing and disposition of questions and answers, makes internal management analysis of problem areas extremely difficult, especially with respect to pinpointing where delays occur.

In addition, we believe that effective management analysis of problem areas is made difficult because (1) realistic schedules are not established for the review of applications and (2) the causes of schedule slippages are not documented fully. We believe also that, because AEC has not formally provided target dates to applicants for their replies to questions, AEC has not placed sufficient responsibility on applicants to take the actions necessary to have their applications processed within the time schedule that they require to proceed with the construction and/or operation of their plants on a timely basis.

RECOMMENDATIONS

To provide improved management controls over the various aspects of the internal review of applications for construction permits and operating licenses, we recommend that AEC:

- Review and revise the procedures used in establishing schedules for the review of applications to

provide for the establishment of realistic target dates for the various phases of the review.

- Require that the causes of schedule slippages be documented fully.
- Require that records be maintained of questions prepared by individual reviewers, the dates of their preparation, changes made to the questions during the internal review process and the dates thereof and reasons therefore, and the bases on which the questions ultimately are resolved.
- Establish specific requirements as to the documentation to be accumulated in support of the various determinations required to be made by reviewers.
- Formally provide target dates to applicants for receipt of replies to questions and point out to the applicants that any delays in the receipt of replies will adversely affect AEC's ability to meet the applicants' proposed schedules.

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AEC advised us (see app. II) that it recognized the importance of improving scheduling in the effective management of the review process and that steps were being taken to develop more effective controls in this area. With respect to the need for additional documentation in the review process, AEC stated that, although more documentation in the review process was desirable, the extent of documentation was a matter which it felt required a careful balancing and judgment to resolve. AEC advised us also that it was looking at the process to determine the reasonable extent to which improvements in the documentation area could be effected.

CHAPTER 4

NEED TO MAKE GREATER EFFORTS

TO DEVELOP AUTOMATED SYSTEMS

TO ASSIST IN THE REVIEW OF APPLICATIONS

Although there is general agreement among regulatory officials that the efficiency of the application review process could be improved significantly through the development of automated techniques, we believe that adequate management attention has not been directed toward this area and that, as a result, the development of such techniques has not been accomplished successfully.

AEC has made one attempt to develop a broad-based automated system to assist in the review of applications for construction permits and operating licenses. This project was called Computer Handling of Reactor Data--Safety (CHORDS). The CHORDS project was initiated during fiscal year 1967 with the objective of developing a capability to document and retrieve numerical technical data to enable a reviewer to compare current application data with prior approved application data and thus to facilitate the licensing review. The project was terminated in June 1971 after management problems were encountered.

Various regulatory officials, including the former Director of Regulation and the Director of DRL, have recognized the current need for computerization of data, similar to the CHORDS concept, to facilitate safety reviews.

The DRL Assistant Director for Pressurized Water Reactors informed us that the technical review time was unnecessarily long and that part of the cause was the need for reviewers to compare reactor characteristics by tedious, time-consuming manual methods. He stated that the time that would be saved by the use of a computer could be spent better on further identification and resolution of safety problems associated with individual applications.

HISTORY OF THE CHORDS PROJECT

The CHORDS project was apparently initiated as a result of a DRL staff memorandum dated March 1966 in which the need to improve the efficiency of DRL safety reviews of applications for construction permits and operating licenses was recognized. The DRL memorandum indicated that the number of applications then being processed was leading to problems relating to coordination of the reviews, consistency of reviews, and the lack of clear identification of evolutionary changes in reactor safety characteristics as they occurred. The memorandum pointed out that these problems would be aggravated as the number of applications increased.

The use of a computer memory to record and retrieve safety characteristics for all reactors, within a standard memory format, was suggested as a means for individuals making safety evaluations to compare characteristics approved by DRL in prior applications with those in an application currently being reviewed. The system would record each reactor's safety characteristics and the basis for DRL approval. In this manner the computer could be used to identify areas of difference from previously approved reactors, which then could be examined in detail by the technical staff. The memorandum pointed out that this system would tend to reduce the effect of personal viewpoints and abilities of individual project leaders on the review process and would ensure greater consistency in reviews.

In September 1966 DRL, in a memorandum to the Director of Regulation, endorsed the concept of using a computer to assist in the safety review of reactor applications and recommended that the regulatory staff obtain funds to proceed with the project. It was anticipated that the project would take several years to complete, that DRL technical direction would be required, and that the project would cost about \$3 million.

DRL stated that the proposed project had been discussed with the AEC Division of Reactor Development and Technology (RDT) and that RDT believed that the Oak Ridge National Laboratory could develop the system. DRL pointed out, however, that:

"While it appears that the advantage of having this work done at ORNL [Oak Ridge National Laboratory] would be that it could start quickly from a funding viewpoint, it is also clear that ORNL does not understand the magnitude of the effort required for the job."

DRL expressed the opinion that, if a decision were made to use the Oak Ridge National Laboratory, differences of opinion among the regulatory staff, RDT, and the Laboratory would reflect on the effort involved and the priority of the effort in relationship to other work to the extent that it would seriously jeopardize a successful task. DRL therefore recommended that funds be obtained for the project on the basis that it would be contracted to a commercial company.

After further consideration the CHORDS project was established as part of the AEC General Manager's nuclear safety program, to be funded by RDT. The project was assigned to the Oak Ridge National Laboratory under the technical direction of the DRL staff.

Available records did not indicate the reason for selecting the Laboratory to conduct the project in view of the concerns that had been expressed by DRL. We were advised, however, that the decision to fund the project through RDT, with the Laboratory as the contractor, had been made because it had been decided that the Laboratory had the capability to conduct the project, because funds were available in RDT's budget, and because no funds were available for the project in DRL's budget.

The major objective of the first phase of the project was to identify and collect input data on reactor safety characteristics for a small number of boiling-water reactors and pressurized-water reactors to test the utility, effectiveness, and adequacy of the program. The second phase of the project was to expand the program to all pertinent characteristics for all nuclear reactors. The Laboratory began work on the project in January 1967.

In October 1967 DRL informed the Director of Regulation that the results to date were disappointing and that there were indications of serious management problems.

Specifically the Laboratory had accumulated inordinately large lists of characteristics and had experienced difficulty in selecting the information from safety analysis reports to be stored in the computer memory. DRL recommended that the selection function be performed by a private firm already under contract to the Laboratory.

On the next day the Assistant Director of Regulation for Administration advised the Director of Regulation that a more fundamental decision had to be made involving the amount of regulatory effort which could be devoted to the CHORDS project, since, in his opinion, many of the problems encountered thus far were caused by the lack of in-house capability to adequately supervise and direct the project.

On March 19, 1968, after a joint meeting with the Laboratory, Laboratory subcontractors, and RDT, DRL gave a status report on the project to the Director of Regulation. This report indicated that the paramount problem of the CHORDS project was the problem of making timely decisions, because both management and staff personnel were under heavy pressure from other work. An additional problem was the need by the Laboratory and its subcontractors for more guidance than was initially anticipated. The report stated that the accumulation of data items would be limited to about 10,000 items for each reactor. In the same memorandum the Director, DRL, again emphasized the need for CHORDS, stating:

"The size and complexity of the present day reactor power plants makes a thorough safety review of each case mandatory. There are presently about 30 reactor cases under review by DRL and ACRS for either an operating license or a construction permit, plus a similar number of facilities which have already been given licenses or permits, but which require follow-up. To cope with this work load, DRL needs new methods and tools such as CHORDS to assist them in performing their reviews. This tool must reduce the amount of manpower required to review a reactor case and must make possible a more sophisticated review of each case. Thus, every effort must be extended toward accomplishing the prime objectives of

CHORDS at as early a date as is reasonable. This means that the prime objectives must be continually kept in mind and the work associated with meeting them religiously pursued. It further means that any tangential effort that might dilute the work on the prime objectives must be curtailed, at least for the time being. Refinements to the CHORDS program and expansion of the scope of the work can always be considered at a later date when the prime objectives are met."

On May 21, 1968, the Assistant Director of Regulation for Special Projects submitted a highlight review and evaluation report of the CHORDS project to the Director of Regulation. This report stated that the project had not yet produced results sufficient to demonstrate the value of the concept on which it was based and that this situation had been caused principally by overemphasis on the development of questionable characteristics lists for use in computer exercises and by underemphasis on searching safety analysis reports for nuclear power plant safety data needed to serve as a basis for the development of meaningful characteristics lists.

The report also pointed out that there had been a lack of adequate communication to enable a technical group, which was not familiar with DRL safety review activities, to develop within a reasonable time information approaches useful to the needs of DRL. The report concluded that the development of meaningful characteristics lists must be performed by DRL staff and not by a group which was neither directly involved in the safety reviews nor familiar with the information needs of DRL.

The report stated that, if the time could not be found for DRL specialists to develop lists of important parameters on which they were routinely trying to extract information from applicants, there was little likelihood that the CHORDS objectives could be achieved.

The report recommended that DRL specialists review the characteristics already developed for CHORDS and develop a list of additional characteristics for inclusion in a CHORDS master list of characteristics. In addition, it was

recommended that work by the Oak Ridge National Laboratory be restricted to appropriate methods of storing and retrieving the information developed by DRL.

In July 1968, when about \$836,000 had been expended on the project, DRL provided the Director of Regulation with a specific plan for accomplishing the recommendations in the May 1968 report. DRL estimated that the cost of completing the recommended effort would be about \$250,000.

We could find no record of any communication or action taken by the Director of Regulation to resolve the specific management problems identified in the highlight report or to implement the plan proposed by DRL. In view of the management problems indicated in previous correspondence and of the possible failure of the project, we believe that a decision as to the future management of the CHORDS project by the Director of Regulation was critical at that time.

In October 1968 the Oak Ridge National Laboratory advised RDT that:

"Recent information from your office indicates that we should proceed on the basis of a FY-1969 budget of \$250,000 with the expectation that completion of the review and evaluation of the program, currently being made by the Director of Regulation and the Division of Reactor Licensing, will result in a more clear definition of the future path to be followed in development of the CHORD-S system. It is anticipated that this information will be factored into the mid-year review and appropriate additional funding will be provided at mid-year. In lieu of more specific direction, we are proceeding on the basis that the \$250,000 is intended to continue the project until the review and evaluation is completed, hopefully before January 1969. In order to accomplish this with the presently indicated funds, we have reduced subcontractors' effort to essentially zero and are making adjustments to the CHORD-S staff as necessary. While we are attempting to thus maintain the basic staff necessary for continuation of the program, it is becoming

increasingly urgent that a decision be made as to the future of the CHORD-S program."

In January 1969 RDT directed that the Laboratory's work on the CHORDS project be terminated. RDT stated that the program had been eliminated because of the reevaluation of the project and because of funding limitations.

A limited amount of additional work on the project was performed subsequently by DRL with some assistance from the Laboratory. We were advised that the costs for this work during fiscal years 1970 and 1971 totaled about \$33,000 and that the total project costs during fiscal years 1967 to 1971 were \$1,070,000.

As of June 1971 the project had been terminated. We were advised by DRL officials that the computerized data developed during the project had never been used by persons involved in the performance of safety reviews.

The former Director of Regulation informed us that the CHORDS project had been terminated because it was doubtful that the objectives could be achieved and because increased in-house manpower resources could not be allocated to the project. He stated, however, that the need for additional resources for the project was not brought to the attention of the AEC Commissioners.

In August 1971 AEC informed the Joint Committee on Atomic Energy that:

"In 1967-1969, the regulatory staff extensively explored possible advantages of a computerized information storage and retrieval system, but concluded that the manpower required to fully implement the system could not be diverted from their direct safety review efforts at this time."

Various regulatory officials, including the former Director of Regulation, have informed us of the current need for some method, similar to the concept of CHORDS, to computerize data to facilitate safety reviews of applications. The Director, DRL, has stated that computer handling of data is feasible, desirable, and absolutely necessary in the long

run. He has estimated that such a project will require three professional staff members and a continuing outlay of about \$100,000 a year. He has pointed out that the information and computer programs developed under the CHORDS project are available for use whenever a similar project might be reinstituted.

CONCLUSIONS

As discussed in previous chapters, the review of applications for construction permits and operating licenses is a highly complex, technical undertaking involving the evaluation of voluminous information and the making of numerous determinations related to the health and safety of the public. Part of the review and evaluation of information is performed by tedious and time-consuming manual methods.

Under these circumstances and in view of the general agreement among regulatory officials concerning the need for automated techniques to improve the efficiency and timeliness of reviews of applications, we believe that regulatory management should have taken additional steps to make available the needed resources and to resolve the management problems that prevented the successful development of the CHORDS system.

Because of indications of disagreement by members of the regulatory staff with the concept of lists of meaningful characteristics being developed by a group (Oak Ridge National Laboratory) that was not directly involved with safety reviews or familiar with the information needs of DRL, we are of the opinion that action should have been taken to provide for more direct involvement by DRL in the development of such information. Further we believe that, if adequate resources were not available to DRL, the need for such resources should have been brought to the attention of the AEC Commissioners.

RECOMMENDATIONS

We recommend that AEC determine, on a priority basis, the specific areas in which automated systems and techniques could be developed to assist in the review of applications and take steps to provide for their development as soon as possible. Specific attention should be given to identifying the appropriate organizational arrangements necessary to successfully manage these development efforts, with particular emphasis on ensuring that full participation is obtained in the development of automated systems by persons responsible for reviewing applications. Such participation

should serve to provide the framework necessary to reasonably ensure that, when developed, the systems meet the needs of the intended users.

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AEC stated (see app. II) that there was no doubt that automated techniques could be useful for improving scheduling and management control and that it expected to turn increasingly to automation in coping with the large volume of regulatory work. AEC advised us that it was examining the application review process, including the areas of scheduling, management systems, data retrieval, and review and evaluation, to ascertain what activities would be most adaptable to automated techniques to determine appropriate priorities for automation.

CHAPTER 5

COMMENTS CONCERNING PROCEDURES

FOR IDENTIFYING AND RESOLVING

SAFETY QUESTIONS REQUIRING

RESEARCH AND DEVELOPMENT EFFORTS

We examined into the procedures followed by AEC in (1) identifying, during the review of applications for construction permits, research and development (R&D) efforts needed to resolve safety questions and (2) determining that the R&D programs had been completed successfully and that all safety questions had been resolved satisfactorily prior to issuance of an operating license.

The provisions under 10 CFR 50.35 state:

"(a) When an applicant has not supplied initially all of the technical information required to complete the application and support the issuance of a construction permit which approves all proposed design features, the Commission may issue a construction permit if the Commission finds that *** (3) safety features or components, if any, which require research and development have been described by the applicant and the applicant has identified, and there will be conducted, a research and development program reasonably designed to resolve any safety questions associated with such features or components; and that (4) on the basis of the foregoing, there is reasonable assurance that, (i) such safety questions will be satisfactorily resolved at or before the latest date stated in the application for completion of construction of the proposed facility ***."

To implement the above provisions, AEC requests applicants for construction permits to identify those safety features or components for which additional R&D is required and the specific R&D programs planned. AEC's review of an

application may identify additional areas requiring R&D programs, and, at AEC's request, the applicant makes references thereto by amendment to the application.

In its reports to ACRS and the public during the construction permit review, AEC identifies, in varying degrees of detail, the R&D programs required to be conducted to resolve open safety questions. Our review of public safety evaluation reports issued by AEC in connection with construction permit reviews showed that AEC presented the following finding, or some variation thereof, with respect to R&D.

"Safety features or components, if any, which require research and development have been described by the applicant and the applicant has identified, and there will be conducted, a research and development program reasonably designed to resolve any safety questions associated with such features or components."

AEC-SUPPORTED RESEARCH AND DEVELOPMENT EFFORTS NOT IDENTIFIED DURING SAFETY REVIEW

In August 1971 AEC advised the Joint Committee on Atomic Energy that regulatory needs for R&D had been partly fulfilled by industry-sponsored programs but that AEC-sponsored programs were necessary also to provide the needed research information and to provide an independent safety assessment capability.

In several applications that we reviewed, the R&D efforts identified had been limited to those to be performed by the reactor manufacturer. The applicants did not identify R&D efforts being supported by AEC to resolve existing safety questions, although in some cases they identified R&D programs completed by AEC in support of their conclusions. A report entitled "Water Reactor Safety Program Plan," issued in February 1970 under the direction of AEC's Division of Reactor Development and Technology, identified 139 unanswered safety questions, of which 44 were categorized as:

"*** very urgent, key problem areas, the solution of which would clearly have great impact, either directly or indirectly, on a major critical aspect of reactor safety."

Many of the items discussed in that report involved R&D efforts being supported by AEC.

An example of an area in which it appears that AEC-supported research should be considered in reaching the determination required under 10 CFR 50.35, that an R&D program reasonably designed to resolve safety questions will be conducted, involves emergency core cooling systems. Following is a discussion of AEC's handling of R&D matters relating to emergency core cooling systems for one case which we reviewed.

The applicant submitted his preliminary safety analysis report in December 1966. The report identified the R&D efforts to be performed by the reactor manufacturer concerning the emergency core cooling system. During its review of the application, AEC identified additional R&D needs related to the system, and the manufacturer agreed to perform the required R&D.

AEC's report to ACRS on May 23, 1967, stated, in regard to emergency core cooling, that:

"The performance and integration of the many systems which provide cooling for the core during accidents is of continuing concern." (Underscoring supplied.)

As a result of its review, ACRS recommended R&D efforts by the manufacturer, and, according to AEC's public safety evaluation report dated July 7, 1967, the manufacturer agreed to perform this R&D. Also the report stated that:

"The performance and integration of the many systems and subsystems which provide cooling for the core during loss-of-coolant accidents is a subject of continuing review and evaluation."

Thus the only R&D efforts related to emergency core cooling systems identified in any of the above-mentioned documents involved programs to be carried out by the reactor manufacturer. No specific target date for completion of these programs was mentioned.

In October 1967 the report of an advisory task force, which was established by the Director of Regulation in October 1966 to conduct an in-depth study of emergency core cooling systems, recommended that additional assurance could and should be obtained that substantial fuel melting could be prevented by emergency core cooling systems.

The water reactor safety program plan (see p. 53) identified extensive R&D efforts being supported by AEC related to emergency core cooling systems. In commenting on a draft of this plan, ACRS advised the AEC Chairman in March 1969 that:

"Emergency Core Cooling

"The ACRS believes this to be a very important area of research. Work is required to confirm the performance characteristics of currently proposed emergency core cooling systems (ECCS) and to predict better many of the processes involved in reactor blowdown, core heatup, etc. It is equally important that improved means be developed for testing and assuring the workability of these systems in the unlikely event of a serious accident. The safety research program should continue to probe for unexpected phenomena and to attack gaps in our knowledge, such as the possibility rapid mechanical interaction between molten fuel and water."

The applicant's final safety analysis report for the case we reviewed, which was submitted in January 1970, included a discussion of the research performed to resolve the safety issues concerning emergency core cooling systems.

In its report to ACRS, dated February 16, 1971, AEC noted that R&D performed by the reactor manufacturer was inadequate to support the applicant's conclusions. Because the cited R&D was not adequate, the reactor manufacturer developed additional information in support of its conclusions. AEC noted that, in evaluating the results of this additional information, it had utilized the results of AEC-supported research. AEC indicated, however, that additional data was needed from the reactor manufacturer before it could complete its evaluation.

In May 1971 AEC announced that:

"The use of recently developed, improved techniques for calculating fuel cladding temperatures following a loss of coolant accident, and the results of some preliminary safety research experiments have indicated that the predicted margins in emergency core cooling system performance for reactors may not be as large as were earlier predicted."

AEC indicated that the research involved had been performed at its National Reactor Testing Station in Idaho. AEC stated that a regulatory staff task force was seeking to determine whether improvements were needed in emergency core cooling system design.

AEC issued a policy statement on June 19, 1971, containing "conservative interim criteria for the performance of emergency core cooling systems." The public safety evaluation report for the application we reviewed was issued in June 1971, and a supplement relating to emergency core cooling systems was issued in July 1971. The supplement indicated that, as a result of the interim criteria, additional calculations had been required and that these calculations had confirmed the adequacy of the system.

The above-described case indicates that AEC-supported R&D is related to the resolution of safety questions. We therefore asked AEC management officials why AEC's safety evaluations at the construction permit stage indicated that only the R&D programs of the reactor manufacturer were required to resolve safety questions but not those of AEC.

The Deputy Director, DRL, informed us that AEC-supported research generally was not cited by AEC as being needed to resolve safety questions prior to the issuance of an operating license because AEC-supported research was related to safety questions of a general nature rather than to questions related to the design of specific reactors. He explained that these general questions had been considered by the regulatory staff in developing criteria for the construction and operation of nuclear power plants and that the criteria were sufficiently conservative to provide an adequate margin of

safety, all of the various unknowns considered. He informed us, however, that no formal study had been made by the regulatory staff that would explain the rationale by which it had been concluded that not one of the safety questions discussed in the water reactor safety program plan was of sufficient significance to require resolution prior to the granting of an operating license.

LACK OF STANDARD PROCEDURES FOR EVALUATING TOPICAL REPORTS

In their final safety analysis reports, applicants make reference to many topical reports prepared by reactor manufacturers or architect-engineers. Topical reports are sometimes used to document the results of R&D programs conducted by the reactor manufacturers. The reports thus serve as evidence presented by an applicant to support his contention that safety questions raised at the construction permit stage have been resolved satisfactorily. As of September 1971 over 150 topical reports had been issued by four nuclear reactor manufacturers and three architect-engineers.

Although the review of topical reports referenced in applications is in many cases an essential part of a safety evaluation, the Director of Regulation has established no standard process for reviewing topical reports and for summarizing the results for use in evaluating future applications. In November 1969 the Assistant to the Director, DRL, attempted to categorize all topical reports according to the extent each had been reviewed and the adequacy of their contents. In December 1969 he noted, in reporting on the results of his attempt to the Director, DRL, that the actions proposed on several reports had not been satisfactory. In addition, he stated the need for a management policy regarding the action to be taken on topical reports submitted in the future.

On August 3, 1970, the Assistant Director (formerly the Assistant to the Director), DRL, in a memorandum to the other DRL assistant directors, stated that the Director, DRL, had ordered that summary reports be prepared stating the disposition of each new topical report received. Enclosed with this memorandum was a list of each topical report received by DRL, the status of its review, and the date and writer of the summary report, if any. Of the 101 topical reports listed at that time, summary reports had been prepared for 22. These reports had not, however, been formally approved by DRL management.

As of November 1971 DRL had no formal system for the approval of topical reports. The Director, DRL, advised us that, because of manpower limitations, topical reports were

reviewed only to the extent to which they applied to particular applications and that no written summary was prepared on these reviews, although the topical reports might be discussed in DRL's report to ACRS. In addition, DRL did not formally advise the reactor manufacturer or the architect-engineer of the results of DRL's review of topical reports although the reports might be discussed informally during meetings.

Our review of several applications indicated that as many as 37 different topical reports had been referenced in an application. Because of the lack of a formal system for documenting the results of reviews of topical reports, however, for many reports there is no method by which individual project leaders can readily determine the extent to which the reports have been reviewed in connection with previous applications.

In September 1971 DRL forwarded a complete list of all topical reports received to the Technical Advisor to the Director of Regulation. The list of topical reports submitted by one reactor vendor was current and included a statement on the review and acceptability of each topical report. Although the list of all other topical reports was updated to September 1971 to include reports received after the August 1970 list was prepared, the list indicated that the status of only one of the reports had changed and that no additional summary reports had been prepared.

Our discussions with four project leaders responsible for reviewing applications involving reactors manufactured by the reactor vendor mentioned above revealed that in November 1971 one project leader had a copy of the list, that one had seen a copy of the list but did not have it, and that the other two were not aware of the list.

In one case that we reviewed, an applicant cited 34 topical reports in support of his final safety analysis report submitted in January 1970. According to the list of topical reports prepared by DRL as of September 1971, summary reports had been prepared for only eight of these topical reports. (We noted, however, that summary reports had been prepared covering four of the other topical reports, but this information was not shown on the list.)

In its report to ACRS, DRL mentioned only three of the 34 topical reports in discussing the resolution of safety questions. The report contained no indication of the extent to which the 31 other topical reports had been relied on by DRL in reaching its conclusions. A summary report had been prepared by DRL for the three topical reports discussed in the report to ACRS. The summary report indicated that each of the topical reports was inadequate in certain respects.

DRL indicated that, with respect to the inadequacies in two of the topical reports, other information had been used to resolve safety questions, including the results of certain AEC-supported research. DRL stated that the experimental data contained in the third report was not adequate to support the conclusions reached by the manufacturer and therefore did not provide a basis for resolving the safety question that had been raised at the construction permit stage. DRL concluded, however, that, even without the research results which had been anticipated, the reactor could be operated safely with the specifications that would be required. No other research results were cited by DRL in support of this conclusion.

We believe that, in view of the indications that topical reports prepared by reactor manufacturers do not always contain adequate experimental data to support the conclusions reached, AEC should develop a system providing for the documentation of each review and evaluation of a topical report in a manner that clearly indicates the areas in which the conclusions reached are supported adequately and the areas in which they are not. We believe also that the evaluations should be formally approved by regulatory management. By this means persons responsible for reviewing applications would be in a position to readily determine the extent of reliance that could be placed on such reports during their review.

RECOMMENDATIONS

We recommend that AEC develop a formal system for reviewing and evaluating topical reports submitted in support of applications to construct and operate nuclear power plants. We recommend also that the system provide for the

documentation of each review and evaluation in a manner that clearly indicates the areas in which the conclusions reached are supported adequately and the areas in which they are not and that the evaluations be formally approved by regulatory management.

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AEC agreed (see app. II) that a system was needed for documenting the evaluation of topical reports and stated that it intended to establish such a mechanism promptly.

CHAPTER 6

ADEQUATE RESOURCES NOT DEVOTED TO

IMPROVING EFFICIENCY OF REVIEW PROCESS

In the previous chapters of this report, we have discussed a number of areas in which management improvements are needed to provide added assurance that reviews of applications to construct and operate nuclear power plants are conducted in a systematic, consistent, and orderly manner.

In many cases the need for improved guidance, procedures, and techniques to improve the efficiency of the review process had been recognized by the AEC regulatory staff, but actions either had not been taken or were not adequate to effect the needed improvements. It appears to us that this situation is attributable primarily to the following items.

- AEC's regulatory management devoted available resources to the review of individual applications and did not give priority to improving the process by which the review and evaluation of applications was conducted.
- AEC's regulatory management did not request specific resources for the express purpose of developing and implementing improvements in the review process.
- AEC did not establish an effective, independent group to conduct management reviews of the activities of the regulatory staff.

Areas in which improvements were needed that had been identified by the regulatory staff included (1) the need for better guidance to applicants, (2) the need for better training and guidance for reviewers, and (3) the need for greater uses of automated techniques to assist in the review process. We were advised that efforts in these areas had been reduced or eliminated because of the need for existing staff resources to be used in the review of applications.

A sharp increase in the number of applications received began in fiscal year 1966. (See p. 13.) From fiscal year

1966 through fiscal year 1971, an average 18.3 applications were received annually compared with an average 4.3 applications received annually from fiscal year 1960 through fiscal year 1965--an increase of 325 percent.

No significant increase in regulatory staff levels occurred prior to fiscal year 1967. As of June 30, 1971, however, the overall regulatory professional staff had increased 92 percent over the fiscal year 1967 level and the number of professional staff members in DRL and DRS had increased 171 percent. Because of the increase in the work load, regulatory management has elected to use the additional resources primarily to review individual applications rather than to effect needed management improvements.

In requesting that we make our review, the Joint Committee on Atomic Energy stated that it was particularly interested in our evaluation of AEC's efforts toward and implementation of management controls designed to ensure that the review of applications for construction permits and operating licenses would be conducted efficiently and would be conducted with effective use of the professional members of the regulatory staff. In our opinion, the regulatory management policy of devoting available resources primarily to reviewing applications rather than to effecting needed improvements in the review process has precluded an adequate effort from being devoted to the development and implementation of such management controls. We found no evidence that regulatory management had brought the need for additional resources to effect management improvements to the attention of the AEC Commissioners.

The average technical review time for each application increased substantially from fiscal year 1967 through fiscal year 1971. (See p. 11.) We believe that a concerted effort by regulatory management to provide improved guidance, procedures, and techniques for reviewing applications would have provided greater assurance that reviews were conducted in a systematic, orderly, and consistent manner and would have placed AEC management in a better position to cope with the substantial increase in applications.

AEC has an internal audit staff in the Office of the Controller which is under the direction of the AEC General

Manager. This internal audit staff, however, has conducted no reviews of regulatory activities.

The Director of Regulation has established, within the Administrative Office, an organization which is responsible for conducting management studies and surveys, in addition to other duties, to effect better utilization of employees and the improvement of regulatory procedures, work methods, and processes. An Administrative Office official advised us, however, that this organization had made no studies of the management of the licensing process.

In January 1971 AEC established a task force to review technical issues, to expedite decisions on unique or difficult technical problems, and to study major generic safety issues to establish regulatory requirements for various classes and generations of nuclear power facilities. This task force, however, has not been assigned responsibility for resolving problems related to the procedural aspects of the review of applications.

Three divisions within the regulatory organization participate in the review--DRL, DRS, and the Division of Radiological and Environmental Protection. The timeliness and efficiency of the review process is dependent upon the degree to which adequate coordination can be achieved among these divisions.

DRL has established a position entitled "Technical Coordinator" under each of the assistant directors responsible for the review of applications, to provide for the coordination of all technical reviews within the various branches under the assistant directors. The technical coordinators are responsible for providing a uniform approach to the safety review of applications. The Director, DRL, advised us that the coordinators had been unable to perform their functions because they had been involved with special problems but that there was a need for the functions of the technical coordinator position to be performed.

In July 1971 a study group was established within the regulatory staff to recommend improved methods of scheduling, coordinating, and reporting on safety and environmental reviews and other activities associated with the

licensing of reactors and other facilities. The Assistant Director of Regulation for Administration advised us in November 1971 that, due to work-load problems, the study group had made little progress.

On November 11, 1971, AEC announced the appointment of a Deputy Director of Regulation for Reactor Licensing to supervise regulatory staff reviews of licensing activities. We believe that the establishment of this position should strengthen management of the review process and should provide improved capability:

- To identify overall financial and personnel needs with respect to the licensing process and to ensure that such needs are brought to the attention of the Director of Regulation.
- To allocate staff resources in the most appropriate manner, considering overall staff availability.
- To establish and implement uniform procedural controls and to improve communications among and within the various groups involved in the review process.
- To develop procedures for making needed management analyses of the various steps of the review process, including those which presently cross organizational lines.
- To ensure that actions are taken if needed to improve the overall review process.

RECOMMENDATION

We recommend that AEC provide for independent, internal audit and management review of the activities under the Director of Regulation on a continuing basis.

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AEC stated (see app. II) that its plans for strengthening the regulatory structure would include the capability for internal management review on a continuing basis.

CHAPTER 7

SCOPE OF REVIEW

Our review was directed toward an examination of the policies, procedures, and practices followed by the regulatory staff of AEC in reviewing and evaluating applications to construct and operate commercial nuclear power plants. The review was conducted at AEC's regulatory offices in Bethesda, Maryland.

We examined pertinent documents, records, reports, and files relating to AEC's review and evaluation of license applications. We interviewed regulatory management officials as well as staff members in each of the operating divisions involved in the licensing process. In addition, we interviewed officials of two utilities involved in licensing nuclear power reactors and of two reactor manufacturers.

Our review was limited to the regulatory staff's review of applications and did not include the safety evaluation made by ACRS. In addition, we did not examine into aspects of the review of applications related to responsibilities imposed on AEC by the National Environmental Policy Act of 1969 and the Water Quality Improvement Act of 1970. These aspects were excluded from our review because significant changes were in process in the policies, procedures, and practices under which the responsibilities were carried out.

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Congress of the United States

JOINT COMMITTEE ON ATOMIC ENERGY

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June 18, 1971

Honorable Elmer B. Staats
Comptroller General of the United States
U. S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Staats:

The Joint Committee requests the assistance of your office for the performance of a review of the Atomic Energy Commission's regulatory staff's internal procedures for the review of applications to construct and operate nuclear power reactors.

The number of these applications has increased substantially during the past several years. Also, during 1970 the AEC was assigned additional regulatory responsibility which must be considered by the regulatory staff in its processing of these applications. I refer in particular to the additional regulatory responsibility imposed on the AEC by the National Environmental Policy Act of 1969 and the Water Quality Improvement Act of 1970. The Committee will commence public hearings on June 22, 1971, on the regulatory procedures for licensing nuclear power reactors.

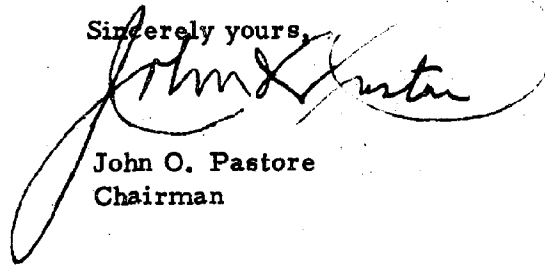
To assist the Committee in its overall review of the regulatory procedures, we request your office to review the internal procedures which are followed by the regulatory staff in processing applications for the construction and operation of nuclear power reactors. This review should be limited to the application review phase of the licensing process for nuclear power reactors. The Committee is particularly interested in your evaluation of AEC's efforts toward and implementation of management controls designed to ensure that the review of such applications is conducted efficiently and with effective use of the professional members of the regulatory staff.

APPENDIX I

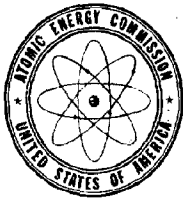
We would appreciate receiving a report on this important matter no later than January 31, 1972. Your report should include specific recommendations on improvements in management controls needed to provide more efficient review of applications for nuclear power reactors, and any other related matters which you deem significant.

The Committee appreciates your assistance and cooperation in this and other matters.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "John O. Pastore", is written over a circular stamp. The signature is fluid and cursive, with a large loop at the end.

John O. Pastore
Chairman



UNITED STATES
ATOMIC ENERGY COMMISSION

WASHINGTON, D.C. 20545

DEC 15 1971

Honorable Elmer B. Staats
Comptroller General of the United States
U. S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Staats:

This is to acknowledge receipt of the draft report to the Joint Committee on Atomic Energy on "Management Improvements Needed in the Review and Evaluation of Applications to Construct and Operate Nuclear Power Plants," by the General Accounting Office (GAO). In accordance with your staff's request we are setting forth our comments concerning the recommendations contained in the draft report for improving the internal review of applications for nuclear facilities.

A number of matters discussed in the GAO report are ones we have recognized, and on which corrective steps have been initiated. As you may be aware, your staff's study was conducted in part during a critical period of change for the Atomic Energy Commission. These changes, which are still in progress, are particularly significant not only for the regulatory organization itself, but for the regulatory program as a whole. Actions on a broad front have been necessary to meet the heavy regulatory workload imposed by the continuing large volume of applications to construct and operate nuclear power facilities, mentioned in Senator Pastore's letter to you of June 18, 1971, and to discharge the greatly expanded AEC regulatory responsibilities imposed by recent environmental quality legislation. Actions have been taken or set in motion with respect to additional manpower, organizational strengthening, improved standards and guides, procedural changes in the hearing process, and a move toward broad rulemaking proceedings to supplant case-by-case handling of problems wherever possible.

We are in general agreement with the recommendations set forth in the draft report, and there follows a more detailed response to each of them. While there are shortcomings in the licensing process which must be corrected, we believe it is important that the report be viewed in perspective. In a short span of time, a new and rapidly changing technology has expanded from a few prototype plants to a civilian nuclear power plant economy totaling 114 nuclear facilities in the safety review process, under construction, or in operation. Throughout

APPENDIX II

Honorable Elmer B. Staats

- 2 -

DEC 15 1971

this period, the primary mission of the regulatory staff has been to focus a high degree of technical competence on the evaluation of power reactor applications in sufficient depth to ensure that the thoroughness and adequacy of review would assure protection of the public health and safety. We are confident that this goal has been achieved. The GAO draft report indicates the technical competence of the review staff. It also recognizes that the workload has increased at a faster pace than the corresponding level of staffing. In our opinion, the difficulties faced by the staff in dealing with the many unique safety problems of a complex, rapidly growing new industry and broadened responsibilities have compounded the task of accomplishing some of the finer management improvements and techniques that are important in expediting the licensing process.

Our comments on specific recommendations contained in the draft report follow. For simplification, some of the recommendations on closely related matters are considered together.

Recommendation

Develop a standardized application format with specifically numbered sections which designate the desired information to be included therein.

Comment

We generally agree with the recommendation, and expect to improve and expand guidance for applicants through development of a standardized application format and other means. This work is underway. In addition to the previously published "Guide for the Organization and Contents of Safety Analysis Reports," we have started a new series of information guides to emphasize current required information in applications in areas where omissions have been prevalent. Of equal importance is our determination, recently announced to the industry, not to accept applications in the future until they are reasonably complete. This will avoid tying up personnel in unproductive work. It must be recognized that in the regulation of a complex, dynamic technology which presents continual changes in concepts and proposed designs of reactors and their components, we cannot expect to develop a standard application format that would, in itself, assure that each safety-related item essential to a thorough review is adequately covered. With this limitation in mind, as indicated above we are proceeding to improve and expand our system of guidance for applicants.

Honorable Elmer B. Staats

- 3 -

DEC 15 1971

Recommendation

Determine the manpower resources needed to develop guides, standards, and criteria and, to the extent practicable, allocate such resources to this task on a full-time basis.

Comment

Full-time manpower commitments to the standards area have been made, and additional staffing needs are being identified. Further, we are exploring other ways and means of intensifying AEC efforts in this field, and of providing for effective management of the overall standards effort. The need for intensive, continuous effort on a concerted basis by the AEC, technical societies and industry to develop more reactor codes and standards is widely recognized. The Division of Reactor Standards was established in 1967 expressly for this purpose. The AEC has been active in encouraging the industry standards groups in this direction, and currently the regulatory staff as a whole is represented on 120 industry code committees and working groups. In addition to criteria and standards work, the regulatory staff has issued 18 Safety Guides during the past year to indicate acceptable solutions to specific safety problems and has many others under preparation or planned.

Recommendation

(a) Provide, on a priority basis, for the development of appropriate training and procedural guidance for reviewers; (b) develop checklists to be used by all responsible reviewers to ensure that consideration is systematically given to all of the issues pertinent to the review and approval of applications; and (c) develop a number of improved management controls related to documentation and scheduling.

Comment

As the draft report indicates, the regulatory personnel responsible for the review and evaluation of applications are highly qualified, professionally trained people with extensive experience in the nuclear field. This background is supplemented by specialized experience and training in safety-oriented aspects of nuclear technology under skilled supervision in the regulatory staff. In addition, supervisory training seminars have been conducted since last August for the regulatory principal staff. While formal training in itself is no substitute for skilled supervision, we are proceeding to develop other appropriate training for the regulatory staff with particular emphasis on training for reviewers.

APPENDIX II

Honorable Elmer B. Staats

- 4 -

DEC 15 1971

As stated in the report, the need for a standardized review plan or guide has been recognized for some time. We will accelerate the development of appropriate checklists for reviewers which are sufficiently flexible to avoid unduly restricting the scope and innovation of review. It is planned that the procedural guidance for reviewers will include, to the extent practicable, information as to (1) the specific safety issues to be evaluated, (2) the type of evidence needed to make the evaluation, and (3) the bases for making necessary determinations.

While more documentation in the review process is desirable, the extent of documentation is a matter which we feel requires a careful balancing and judgment to resolve. The regulatory staff reaches many professional judgments and decisions in the course of which documentation at every step could prove unproductive. The problem of how far documentation could go is indicated by the fact that the technical review is an iterative process involving many people and numerous meetings. We are looking at the process to determine the reasonable extent to which improvements can be effected. We recognize the importance of improving scheduling in the effective management of the review process, and steps are being taken to develop more effective controls in this area.

Recommendation

Determine the specific areas in which automated systems and techniques could be developed to assist in the review of applications and take steps to provide for their development as soon as possible.

Comment

There is no doubt that automated techniques can be useful for improving scheduling and management control, and we expect to turn increasingly to automation in coping with the large volume of regulatory work. We are examining the process, including the areas of scheduling, management systems, data retrieval, and review and evaluation to ascertain what activities would be most adaptable to automated techniques in order to determine appropriate priorities for automation.

Recommendation

Develop a formal system for reviewing and evaluating topical reports submitted in support of applications.

Comment

We agree that there needs to be a system for documenting the evaluation of topical reports. We intend to establish such a mechanism promptly.

DEC 15 1971

Honorable Elmer B. Staats

- 5 -

Recommendation

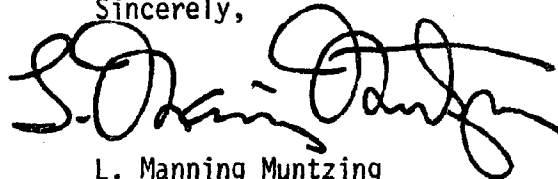
Provide for independent, internal audit and management review of the activities under the Director of Regulation on a continuing basis.

Comment

Part of our plans for strengthening the regulatory structure will include the capability for internal management review on a continuing basis.

We understand that the GAO made certain changes in the draft report to include all pertinent facts and to place the findings in proper perspective. I wish to express our appreciation for the opportunity to review this document and to submit the foregoing comments.

Sincerely,

A handwritten signature in black ink, appearing to read "L. Manning Muntzing", with a stylized flourish at the end.

L. Manning Muntzing
Director of Regulation

Copies of this report are available from the U. S. General Accounting Office, Room 6417, 441 G Street, N W., Washington, D.C., 20548.

Copies are provided without charge to Members of Congress, congressional committee staff members, Government officials, members of the press, college libraries, faculty members and students. The price to the general public is \$1.00 a copy. Orders should be accompanied by cash or check.

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